BENEFICIAL MANAGEMENT PRACTICES

Environmental Manual for Alberta Cow/Calf Producers

ENVIRONMENT
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Alberta Beef Producers

Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT

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FOREWORD

Beneficial Management Practices: Environmental Manual for Alberta Cow/Calf Producers

These farm practice guidelines were developed for Alberta's cow/calf producers through the co-operation of industry, government and interested stakeholders to create greater awareness and understanding of beneficial environmental management practices. This publication is based on the best available research and years of experience.

While the authors have made every effort to ensure that the manual is accurate and complete, it should not be considered the final word on the areas of law and the practices it covers. Producers should seek the advice of appropriate professionals and experts as the facts of each situation may differ from those set out in the manual.

The guidelines are intended to provide a range of management options for cow/calf producers of various sizes and types. The operations dealt with in this manual relate only to cow/calf production and do not include other operations, such as backgrounding, that a cow/calf producer may participate in. Operators that are managing animals under other more intensive operations should refer to the *Beneficial Management Practices: Environmental Manual for Feedlots in Alberta.*

This document will be updated regularly to incorporate new proven technologies and information on environmental practices. Individuals not experienced in cow/calf production practices should not extract portions of this publication, nor draw inference, without considering all aspects of production. These guidelines should not be adopted literally into legislation, in whole or in part, by any level of government.

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Alberta Beef Producers
Alberta Agriculture, Food and Rural Development

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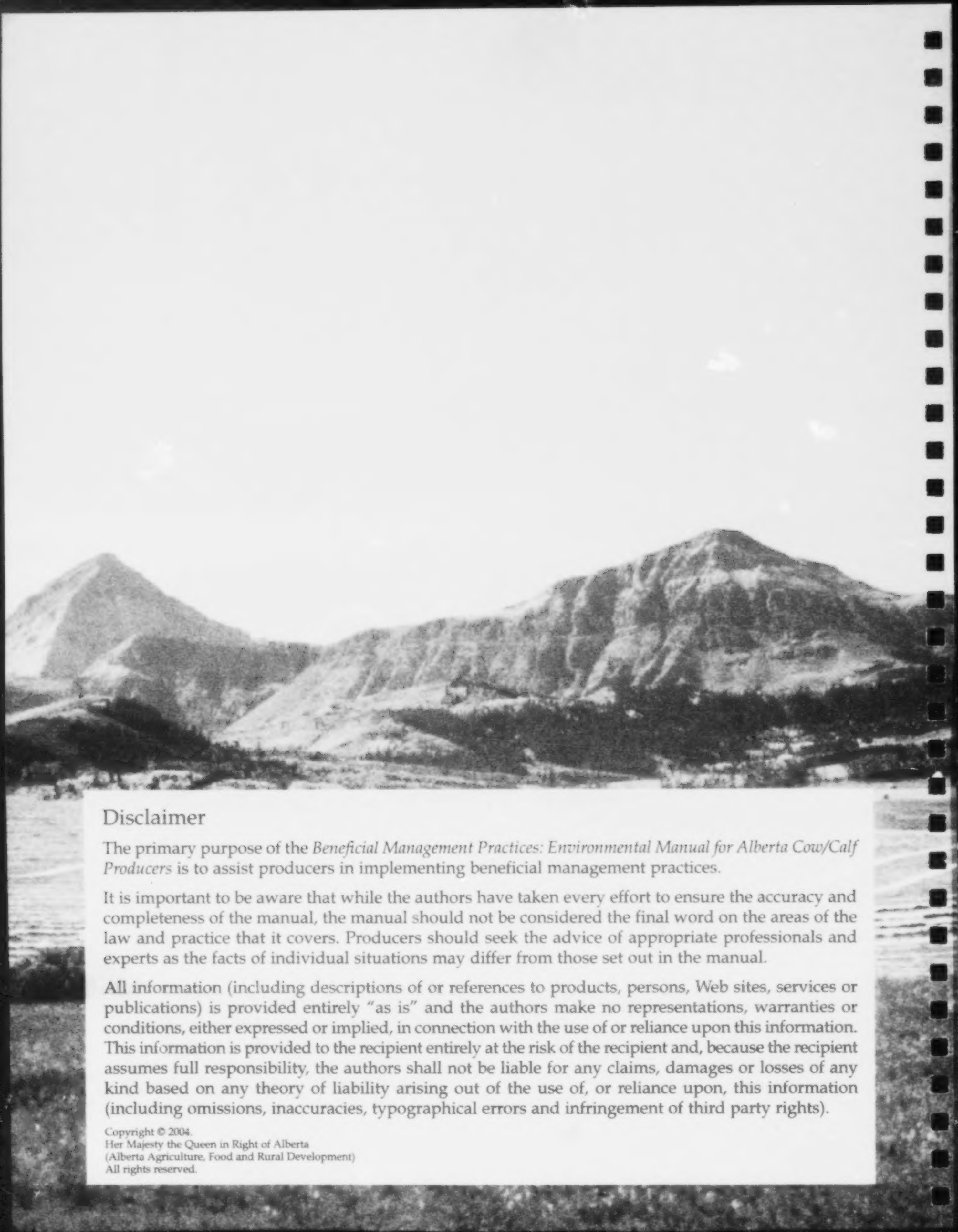

Disclaimer

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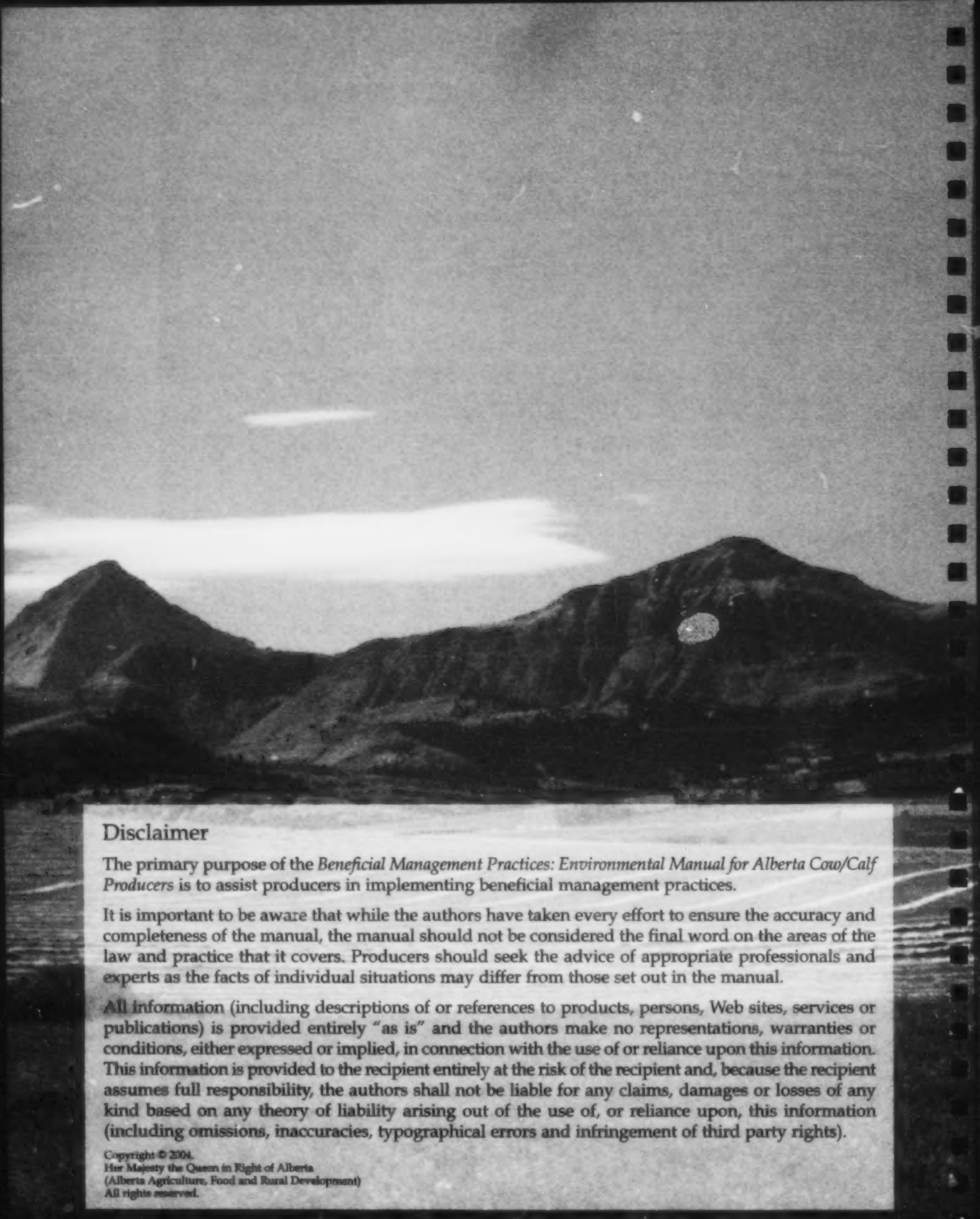

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BENEFICIAL MANAGEMENT PRACTICES: ENVIRONMENTAL MANUAL FOR ALBERTA COW/CALF PRODUCERS

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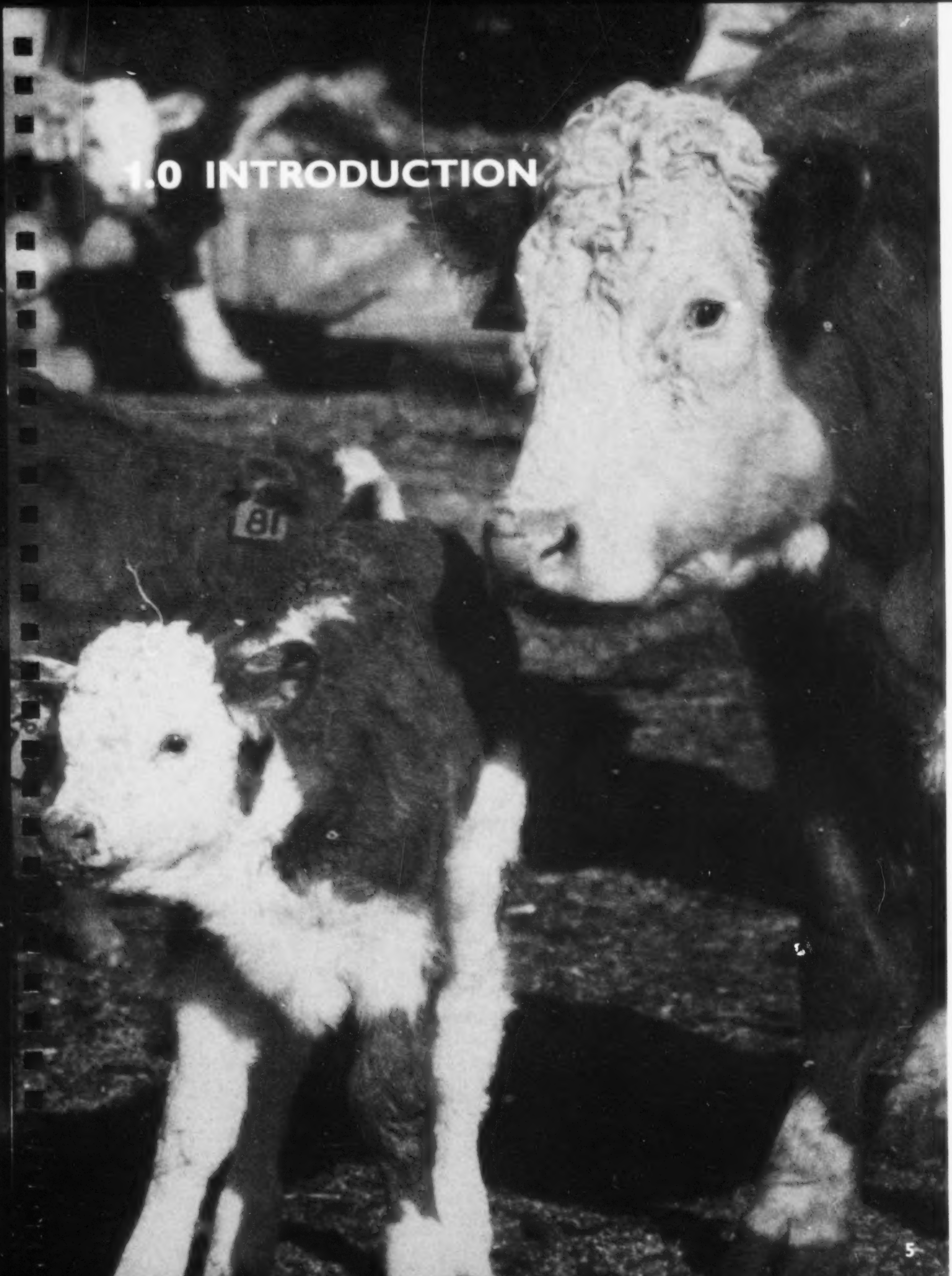
1.0 INTRODUCTION



1.0 INTRODUCTION

A strong connection to the land and the environment has always been at the heart of farming. Over the past 20 years, that tie has taken on new meaning as society has placed a higher level of importance on environmental care. Today's agricultural industry must be aware of these changes in public opinion.

Alberta beef producers are leaders in operating an environmentally responsible, sustainable and prosperous cow/calf industry. To remain competitive in world markets, cow/calf producers need to use common sense, appropriate management practices and scientific knowledge to minimize environmental impact and maintain public confidence.

For agriculture to remain productive, it must protect the diverse ecosystems in which it operates. Producers must consider the natural features of their land, such as wetlands, trees and native range when managing their operations. Enhancing farm habitat and conserving biodiversity will help maintain a healthy environment capable of supporting sustainable food production. Ultimately, maintaining a healthy environment is in the interest of society as a whole.

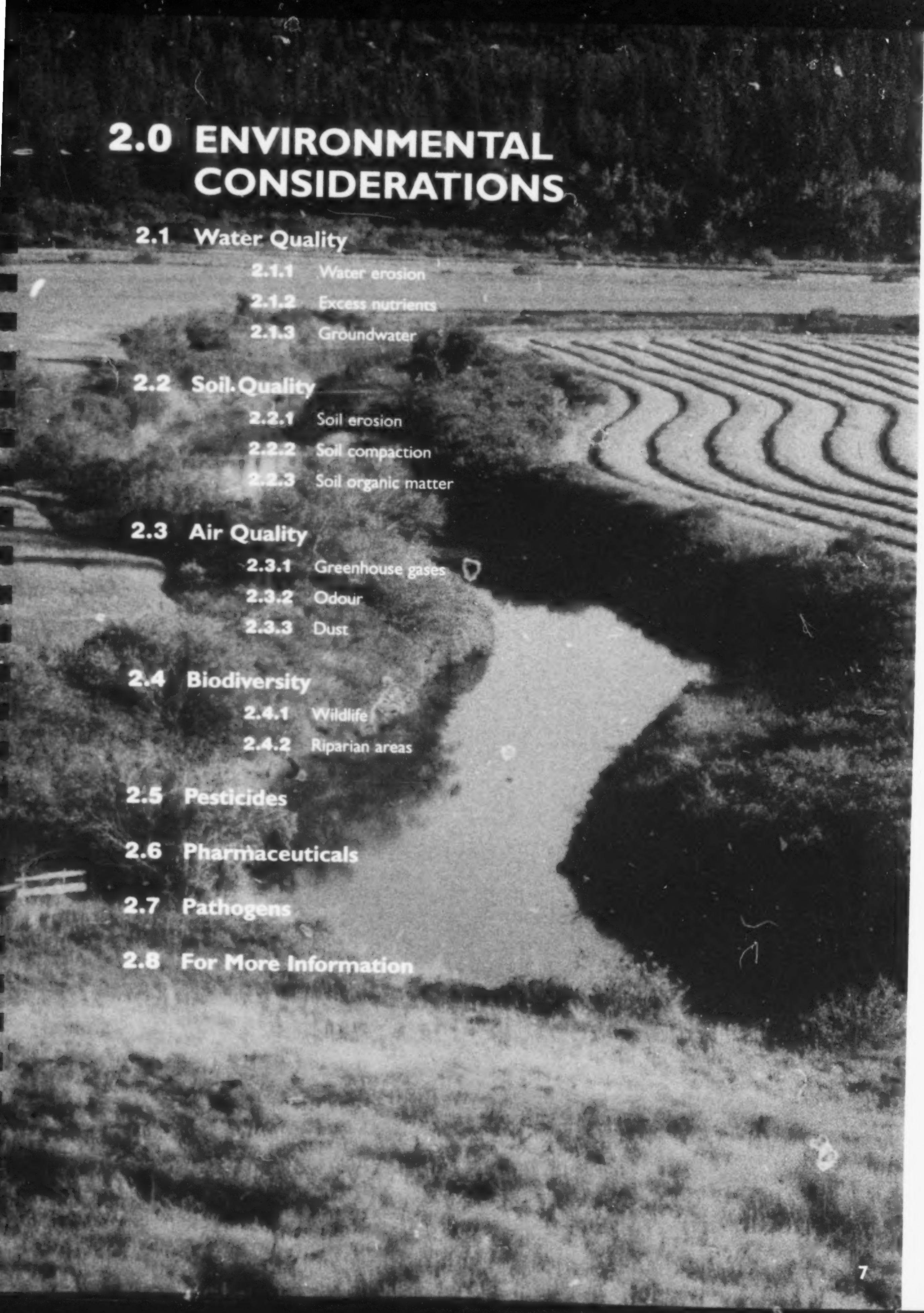
Technology, science and information are changing the cow/calf industry. More operations are specializing in a particular area of production, and are developing alliances and integrating with other sectors of the industry. These changes are another reason the industry needs to become more aware of environmental impacts.

Beneficial Management Practices: Environmental Manual for Alberta Cow/Calf Producers was developed to inform and educate producers on beneficial management practices (BMPs) that can enhance soil, water, air and biodiversity. These BMPs protect the environment while keeping production practical and within the law. The manual should be considered general and not specific to any operation. As every operation is unique, BMPs should be applied and modified based on the specific operation.

This manual includes information in the following areas:

- Management according to landscape characteristics.
- Site planning and management.
- Water supply management.
- Manure management.
- Grazing management.
- Pest control.
- Feed storage management.
- Management of agri-chemicals, petroleum products, medical wastes and dead stock.
- Community relations for cow/calf operations.
- Legal requirements for cow/calf operations.

2.0 ENVIRONMENTAL CONSIDERATIONS



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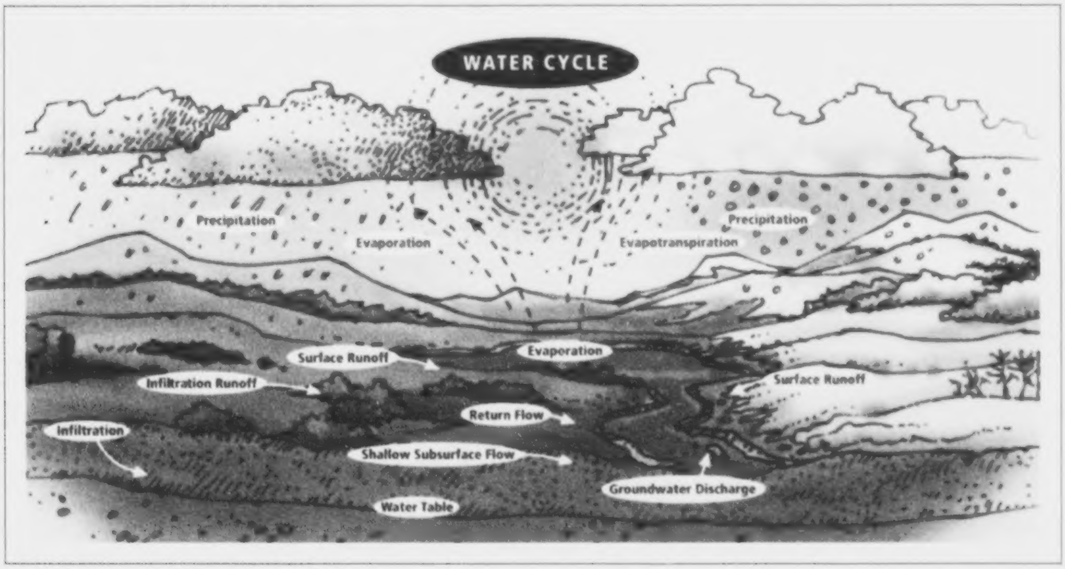
2.0 ENVIRONMENTAL CONSIDERATIONS

This section provides background information on the environmental risks associated with cow/calf production and encourages cow/calf producers to consider the environmental consequences of their management decisions. This section will discuss the impacts on air, soil, water and biodiversity, as well as nuisance issues associated with cow/calf production. Beneficial management practices (BMPs) designed to mitigate the impact of cow/calf operations on the environment are found in following sections. Legislation regarding environmental issues is discussed in Section 13 of this manual.

2.1 Water Quality

Agricultural activities, when improperly managed, can have a significant impact on the quality of water resources. Cropping and livestock practices can produce contaminants including sediment, nutrients (nitrogen and phosphorus) from inorganic fertilizers and organic livestock wastes, pest control chemicals such as herbicides and insecticides, micro-organisms from livestock wastes, salts and trace elements. Contaminants can enter surface and groundwater, either attached to sediment or dissolved in water, throughout the water cycle. Impacts on water quality can restrict water suitability for uses such as potable water, stock water, irrigation, sport fishing and other recreation.

Figure 2.1 **Water Cycle**


WATER CYCLE
Precipitation
Evaporation
Evapotranspiration
Precipitation
Surface Runoff
Evaporation
Infiltration Runoff
Surface Runoff
Return Flow
Infiltration
Shallow Subsurface Flow
Groundwater Discharge
Water Table

2.1.1 Water erosion

Water running over the surface of the soil, called runoff, can pick up, carry and deposit soil particles, which can lead to water erosion. Water erosion removes topsoil, limiting the productivity of the land. If the eroded particles are carried and deposited in a water body, water quality and aquatic habitat are impacted.

Factors affecting the risk of water erosion:
Soil covered by plants or plant residue is less susceptible to water erosion than bare soil. Crop residue and growing plants absorb the impact of raindrops and slow the flow of runoff, therefore reducing the risk of erosion. Roots hold soil in place and add to the organic matter content of the soil, which further enhances its stability.

- The greater the amount and intensity of snowmelt or rainfall, the greater the risk of water erosion.
- Long steep, uninterrupted slopes are especially prone to erosion because water accelerates as it travels downslope.
- Fine to medium-textured soils, especially clay and silt low in organic matter, are the most prone to erosion.
- Clay soils can be prone to crusting, which limits water infiltration (the movement of water into the ground). Less infiltration means more runoff and a greater risk of water erosion.
- Soils with a shallow, impermeable layer (hardpan) are more prone to erosion because this layer limits water infiltration.
- Excessive tillage leaves soil prone to water erosion by compacting the soil, thus decreasing its ability to absorb water. Tillage also removes the protective vegetative cover and reduces organic matter.
- Soils high in organic matter can absorb more water than those low in inorganic matter.

2.1.2 Excess nutrients

Elevated nutrient levels in watercourses can be caused by manure or fertilizer entering a watercourse directly, or by runoff from fertilized fields and livestock sites. Nutrients, primarily phosphorus and nitrogen, accelerate eutrophication of water bodies.

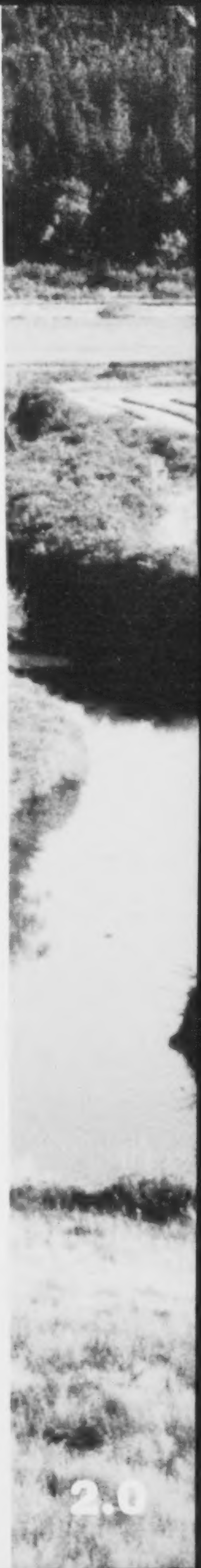
Spills, improper storage and over-application of fertilizers or manure may lead to excess nutrient concentrations in soil and runoff.

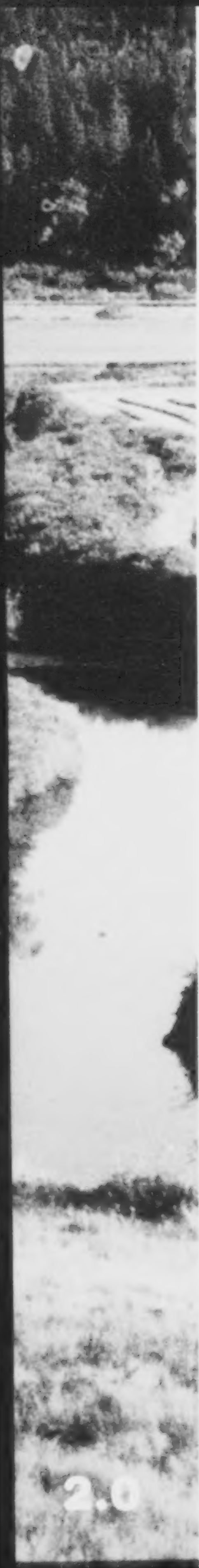
The main nutrients of concern are nitrogen, phosphorus and potassium.

- Excess nitrogen and phosphorus can cause soil and water quality problems.
- Excess potassium on forages can result in reduced feed quality.
- An overabundance of these nutrients can result in toxicity to plants and reduce crop yields.

As well, nutrients that are not used by plants can leach out of the root zone and contaminate groundwater. Over-application of manure on cropland or forage land can also elevate nitrate levels in shallow groundwater.

Eutrophication is the nutrient enrichment of surface waters. The most visible effects of eutrophication are massive blooms of algae and other aquatic plants. When algae and aquatic plants die, oxygen is depleted, reducing fish survival. As well, the decay of blue-green algae is toxic to domestic animals that drink the water.





2.1.3 Groundwater

Groundwater is the water that collects in the pore spaces of soil and rocks. **Aquifers are water-bearing layers that hold groundwater in usable amounts.** Typical aquifers are overlaid by very tight deposits such as clay or shale. Unconfined aquifers or water table aquifers are close to the ground surface and are directly exposed to the atmosphere through spaces in the soil. As a result, the risk of contamination to unconfined aquifers is great. Over-application of nutrients can result in nutrient leaching directly into the groundwater.

A confined aquifer is trapped below an upper confining layer of rock, clay or shale. Contamination of confined aquifers occurs when contaminants move directly into the well from the wellhead or through an improperly maintained well casing.

Seepage from improperly constructed or maintained manure and silage storage structures and the associated risk of groundwater contamination are serious concerns in some areas, particularly where the subsoil underlying the storage consists of sand, gravel or fractured bedrock that allows movement of contaminants through the soil profile to shallow groundwater.

The water table is the point at which the soil pore spaces are 100 percent saturated with water. This may or may not be water that can be collected for use.

2.2 Soil Quality

Maintaining soil quality is the key to maintaining healthy and productive landscapes. Soil quality is important to support and sustain crop, range and woodland production as well as water supplies.

Soil quality can be degraded by inappropriate tillage and cropping practices, excessive livestock grazing or improper application of animal manure, fertilizers or pesticides.

2.2.1 Soil erosion

Soil erosion refers to the loss of soil due to wind or water. Erosion potential depends on the specific topography, climate and soil type of a region and on the management practices used at the site. Erosion removes topsoil, the most productive soil layer, reducing the levels of organic matter and nutrients, which results in lower productivity. Wind and water erosion can cause environmental problems if eroded soil particles become airborne or enter water bodies. As well, eroded soil can carry pesticides and nutrients that further decrease water and air quality. Water erosion can be the result of surface runoff from rainfall, irrigation or snowmelt. Wind erosion occurs when soil is not adequately covered, allowing strong winds to pick up and carry soil particles.

To avoid soil erosion when applying and incorporating manure, a balance must be achieved between the benefits and consequences of incorporation techniques. Incorporating manure prevents nutrient losses and mixes organic matter into the soil, which increases the binding of soil particles and reduces the potential for erosion. However, excessive tillage and compaction reduces soil porosity and destroys soil structure and its aggregate characteristics. This reduces the movement of water, air, nutrients and soil microbes through the soil. Timing manure application to avoid applying manure on wet soil is critical to reduce soil compaction. Farm traffic, especially on headlands, can cause soil compaction, particularly when the soil is wet.

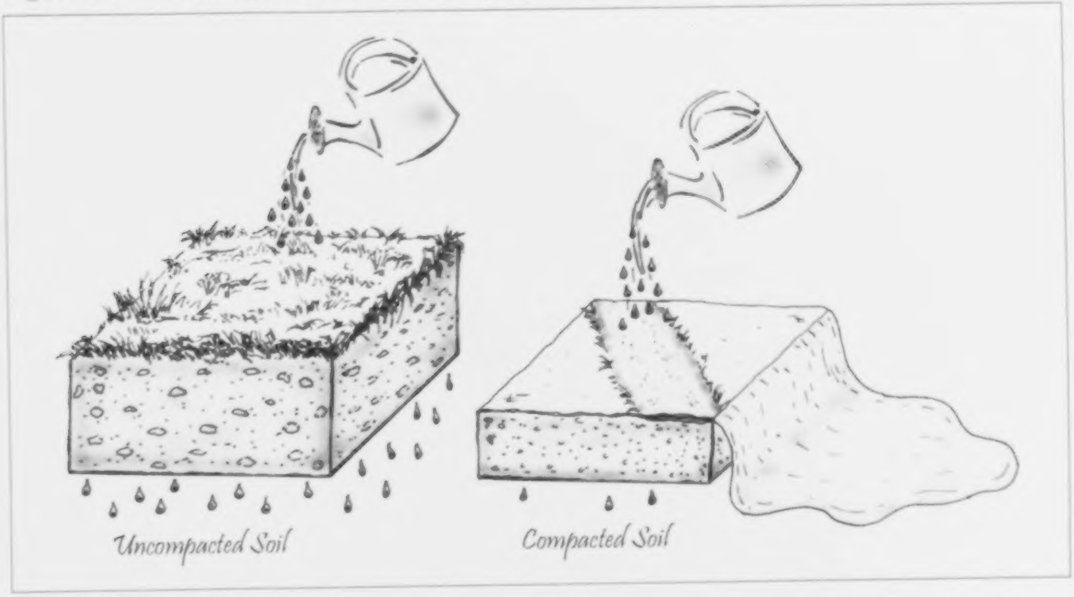
2.2.2 Soil compaction

The compaction of soil by cattle can limit the productivity of the land. One hoof of a mature cow can exert approximately 20 to 30 pounds of pressure per square inch. This reduces soil porosity and the productive capacity of the forage, pasture or crop. Typically this occurs when cattle are permitted to overgraze a pasture or range as a result of inappropriate grazing strategies.

Symptoms of soil compaction are:

- Uneven plant growth.
- Nutrient deficiencies.
- Plant water stress.
- Shallow root systems.

Figure 2.2 **Relation of Soil Compaction to Water Retention**



2.2.3 Soil organic matter

Soil organic matter is composed primarily of plant residue in various stages of decomposition. Organic matter accumulates in soil when plant residues are added or returned to the soil more quickly than soil micro-organisms are able to decompose them. Organic matter occurs naturally in all Alberta soils, though the amount varies considerably according to location.

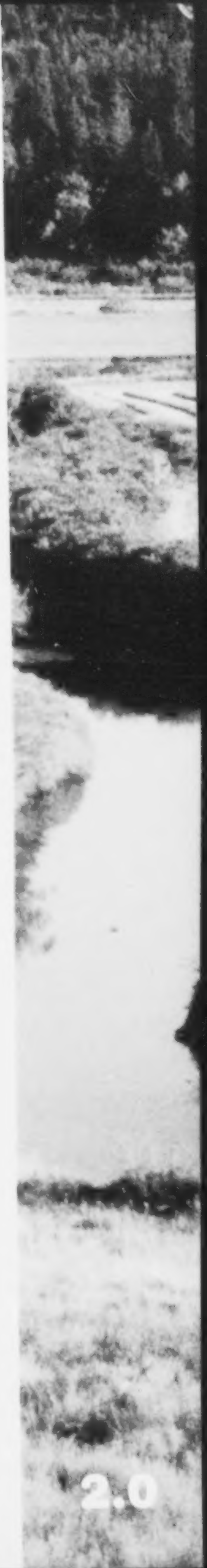
Organic matter improves the physical and chemical properties of soil by:

- Holding individual soil particles together in soil aggregates, therefore reducing the risk of soil erosion.
- Improving soil structure, workability, aeration, water infiltration and water-holding capacity.
- Reducing the risk of soil surface crusting, which can reduce or prevent seedling emergence.
- Storing and supplying nutrients that are essential to plants and soil micro-organisms.

Loss of soil organic matter results in reduced fertility, poor water-holding capacity, greater risk of erosion and lower crop yields.

Factors affecting organic matter content:

- Organic matter tends to accumulate more quickly in cooler, wetter areas, and decomposes more quickly in warmer, drier areas.
- Optimal fertilizer usage, including manure, increases organic matter levels by increasing production and therefore the amount of residue (the plant material remaining after grazing or haying, including leaves, stems and roots).
- Practices that leave soil prone to erosion increase the loss of organic matter.



2.3 Air Quality

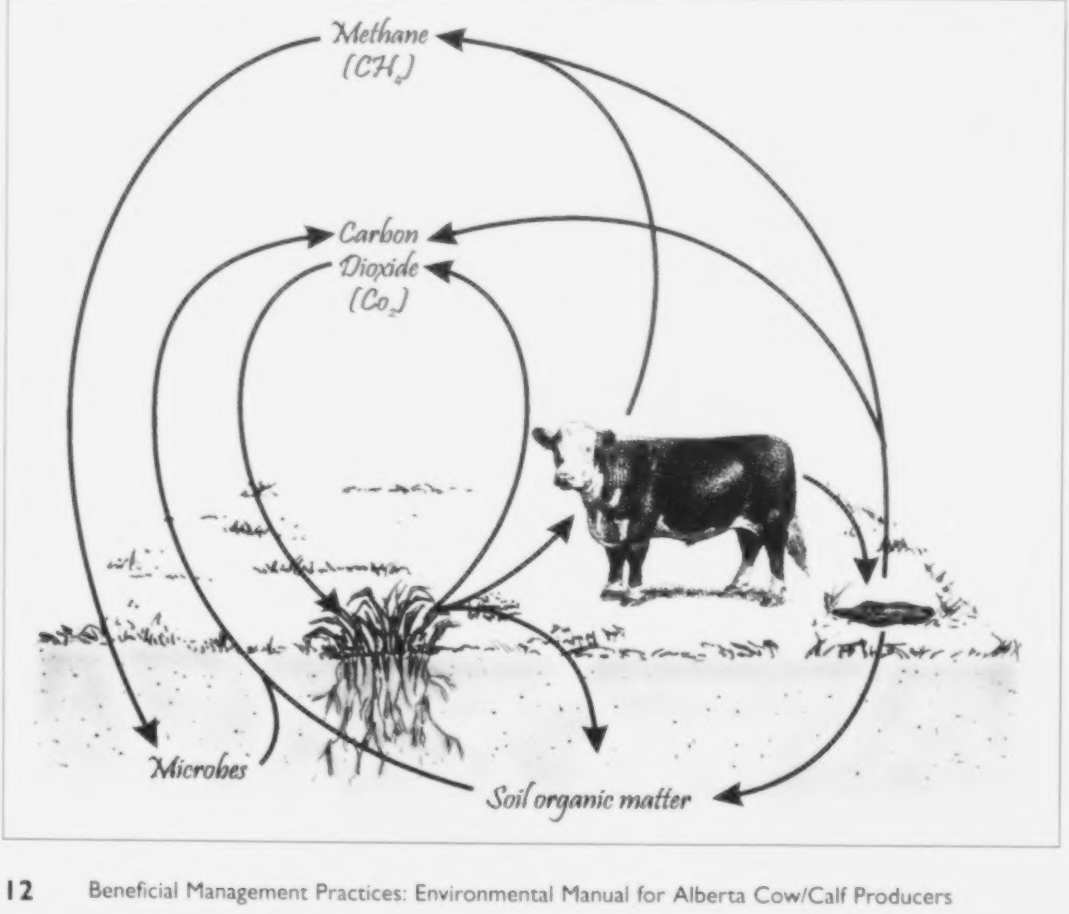
2.3.1 Greenhouse gases

Some gases emitted by livestock operations may have an impact on global warming. Global warming refers to the increase in the earth's surface temperature, which many scientists believe is a result of an increase in the concentration of specific greenhouse gases. Water vapour, carbon dioxide, methane, ozone, halocarbons (used in refrigerants) and nitrous oxide are the main greenhouse gases in the atmosphere. Global warming could result in more extreme weather events such as tornadoes, droughts and winter storms, leading to increased forest fires and damage to water resources. For agricultural producers, seeding dates, crop variety choices, pest and disease management, and water resources may be affected by increases in climatic variability.

The main greenhouse gases emitted from cattle are methane and nitrous oxide. Research indicates that more than 80 percent of the nitrogen animals digest is excreted in their manure and urine. All animals produce methane during digestion, but cattle and other ruminants produce more methane because of the slow fermentation of feed in the rumen.

Greenhouse gas emissions from livestock are also directly related to feed and nutrient losses. Even small changes in management practices can increase feed efficiency:
- Feed higher quality feed and rations.
- Feed lipids, such as canola oil, that add energy and inhibit methane production.
- Add bacterial supplements to feed to help convert methane in the rumen to carbon dioxide and to improve overall digestion.

Figure 2.3 **CO_2 and CH_4 Flow in a Livestock Based Agro-Ecosystem**



Manure emits more methane when it decomposes under low oxygen (anaerobic) conditions (e.g. poorly aerated manure piles). Manure management at all stages (e.g. stockpiling, composting, storage and spreading) influences the amount of methane released. Specific management practices can ensure the nutrients in manure make their way into soil where plants can use them. These practices include:

- Distributing winter feed sites over a large area to encourage cattle to spread out, which more evenly distributes manure.
- Frequently moving the bedding pile to encourage cattle to use all pasture areas.
- Feeding livestock on level ground to prevent manure runoff from entering nearby water bodies.
- Limiting livestock grazing in riparian areas.
- Encouraging the growth of beneficial insects to ensure manure is recycled into the soil.
- Using proper methods when composting to *avoid anaerobic conditions.*

These practices will also minimize the amount of methane and nitrous oxide emitted.

Good range management is the key to reducing greenhouse gas emissions when cattle are on pasture. It increases forage productivity and root mass development, which maintain more carbon in the soil. Good range management involves intensive grazing, which ensures the maintenance or improvement of pasture quality. Swath grazing can also extend the grazing season and reduce emissions.

2.3.2 Odour

The primary complaint about livestock operations is odour. The impact of odour on human health and well-being causes concern, especially when odours are disagreeable and persistent. However, odour is generally considered a nuisance to neighbours rather than a health risk because of the degree of dilution and dispersion that occurs in the air within short distances from the odour source.

2.3.3 Dust

Dust, in addition to being a social concern, creates environmental problems. It can cause respiratory problems for people and animals and it can reduce visibility on roadways. Dust may carry particles from vehicle emissions and manure volatilization. It will also carry odour.

Factors affecting dust levels:

- Areas susceptible to wind erosion are at a greater risk of contributing dust to the atmosphere.
- Higher vehicle speeds, increased traffic and lower moisture conditions on gravel roads can increase dust levels.

2.4 Biodiversity

The loss of biological diversity can decrease future land use opportunities and threaten sustainability. Biodiversity is an important part of various ecological processes. The creation of flora and fauna monocultures, through the loss of wetlands, riparian areas and wildlife habitat and improper pest management can impact the environmental sustainability of agriculture.

A loss of biodiversity affects agriculture in many ways. For example:

- A loss of wetland and riparian habitat has a direct negative effect on the water cycle, water quantity and quality.
- Decreasing the diversity or variety of wild species means less genetic material available for natural evolution.
- A decrease in soil organisms inhibits decomposition, the cycling of nutrients and energy, and the formation of soil.
- Insect species that are critical as crop pollinators and biological pest control agents can be lost.

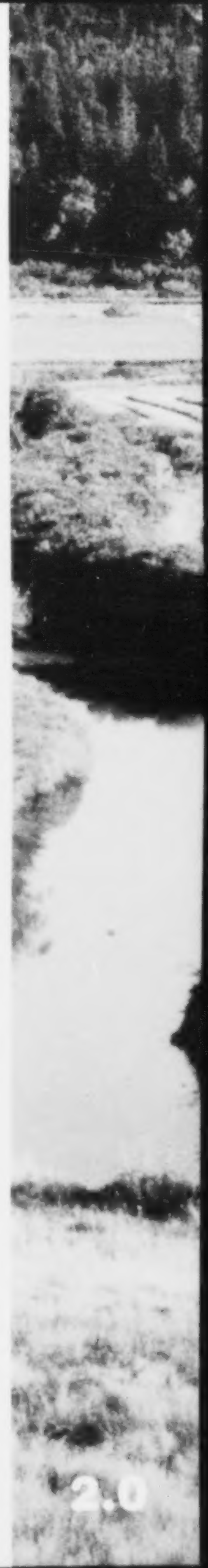
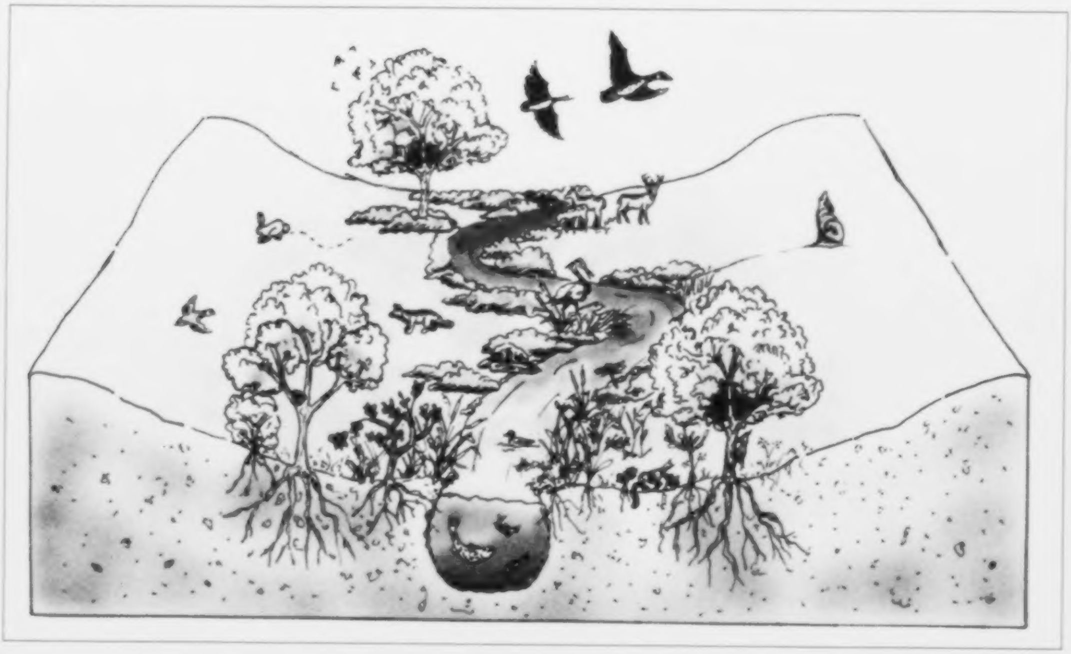


Figure 2.4 **Biodiversity**



2.4.1 Wildlife

Agriculture relies on biological diversity and natural resources to sustain key functions of agro-ecosystems that support food production and security. Conserving and restoring wildlife habitat contributes to biodiversity, and aids the environmental functions on which agriculture depends. These functions include:

- Protection of water quality.
- Regional water cycling.
- Nutrient cycling.
- Maintenance of soil fertility.
- Pollination.
- Pest control.
- Climate regulation.

Agricultural ecosystems (or agro-ecosystems) refer to ecosystems used in agriculture. Each species in an agro-ecosystem is part of a web of relationships connected by flows of energy and materials. Farmers and ranchers manage this flow on their land. Healthy, diverse habitats provide recreational, economic and quality of life benefits as well as other environmental benefits for farmers and rural communities.

Producers must be attentive to factors that affect wildlife habitat on pasture and hayland. Practices that protect soil, water and air quality are also beneficial to habitat. These practices include:

- Rotational grazing.
- Leaving carryover.
- Maintaining healthy riparian areas along streams and lakes.

The following practices that may harm wildlife should be avoided:

- Draining or backfilling wetlands, whether they are permanent or temporary.
- Pesticide applications, which can harm non-target plants and animals if not managed properly.
- Land uses that fragment natural landscapes and reduce habitat quality by limiting the movement of wildlife from one area to another.

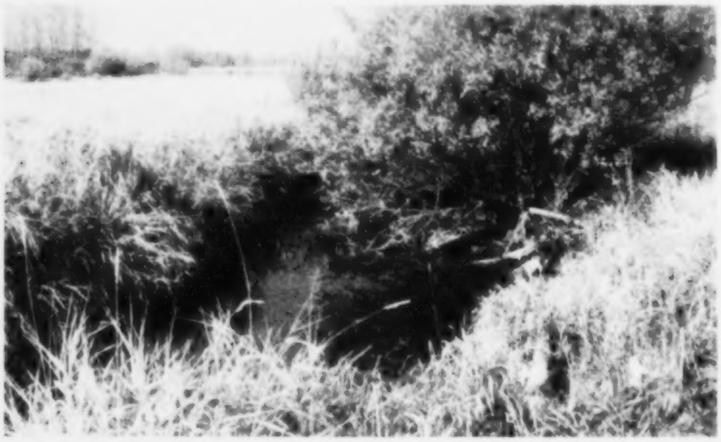
2.4.2 Riparian areas

Riparian areas are the lands adjacent to water bodies where the landscape, vegetation and soils are strongly *influenced by the presence of* water. Healthy wetlands and riparian areas are important to reduce flooding, prevent erosion, protect water quality and provide habitat. They are an essential part of water cycles and local ecosystems.

Degradation of riparian areas can have a negative impact on the environment:

- *Water quality and quantity* will be reduced.
- Salinity control provided by wetlands will decrease.
- The recharging of groundwater and surrounding soil moisture levels will decrease.
- Biodiversity will diminish, as will many opportunities for recreation such as hunting and fishing.

Figure 2.5 **Healthy Riparian Area**



2.5 Pesticides

Pesticides include insecticides, herbicides, fungicides and rodenticides. If not handled and applied properly, pesticides can be a risk to non-target organisms, applicators and workers. During pesticide application, spray droplets, mists or vapours form. These airborne particles can drift and contaminate adjoining properties and water. Soil pollution can occur when pesticides are applied using improper application methods or rates, when disposal protocols are not followed and during spills. Storing pesticides increases the potential for a significant pesticide spill to occur.

Pesticide mismanagement can harm beneficial insects, inhibit plant growth and reduce the viability of forage varieties. Consumption of contaminated plants or soil may harm domestic animals and wildlife. Pesticides that accumulate in plant and animal tissue can make food unfit for human consumption. Pesticides have great potential to pollute both surface and groundwater. Water pollution from pesticides can be the result of drift, runoff, leaching, erosion of contaminated soil, spills and direct application. The severity of pesticide contamination depends on the toxicity and management of the pesticide in question.

2.6 Pharmaceuticals

A range of pharmaceutical products, including antibiotics and reproductive hormones, are used in the cattle industry. While most of these products are completely broken down in the animal's body, some pharmaceutical residues can be excreted at very low levels. Because the residue amount present in manure is extremely small, there may not be any effect on animals that come in contact with the residue. Thus far, there has been no evidence that residues from pharmaceuticals used in cattle production have created problems with the health of humans, wildlife or the environment.

2.7 Pathogens

Disease-causing micro-organisms are referred to as pathogens. Diseases that can be transmitted from animals to humans, causing disease in both, are referred to as zoonoses or zoonotic diseases.

How disease is transmitted from manure. Manure pathogens are most often transmitted through the fecal-oral route (i.e. ingestion of manure or manure-contaminated feed or water). In livestock, this can occur by drinking water contaminated by manure, grazing on pasture recently spread with manure or directly ingesting manure. Humans can ingest manure pathogens by drinking contaminated water, swimming in contaminated surface water and by not washing hands after handling infected livestock or manure. People most at risk of contracting zoonotic disease are those working with animals or handling manure. Zoonotic diseases that are transmittable from cattle to humans include brucellosis, tuberculosis and salmonellosis.

In order for manure pathogens to cause disease through water contamination, several steps need to occur. If any one of these steps is blocked, transmission will not occur.

- First, the pathogen has to be excreted by the animal. Not all pathogens are found in every animal and some pathogens can be reduced through management or medication.
- Second, the pathogen has to reach a water supply by the animal defecating in the water, from surface runoff or from contaminated groundwater flow.
- Third, the pathogen must remain alive and capable of causing infection by the time it is ingested. Heat, cold and dryness can destroy many pathogens in a short period of time.
- Fourth, the pathogen must be ingested in high enough numbers to cause infection. For example, *Salmonella* must be ingested in very high numbers to cause disease, whereas only a few *Cryptosporidium* organisms will cause disease.

It is often difficult to determine the source of a waterborne disease outbreak. Many of the same disease-causing micro-organisms are found in wildlife, pets and human sewage. If testing finds the suspect organism in one location, its source cannot be automatically assumed. Testing many sources and using new diagnostic techniques to determine the strain of the organism are usually necessary to pinpoint the source of disease.

2.8 For More Information

Contact the following offices for the publications listed or for more information.

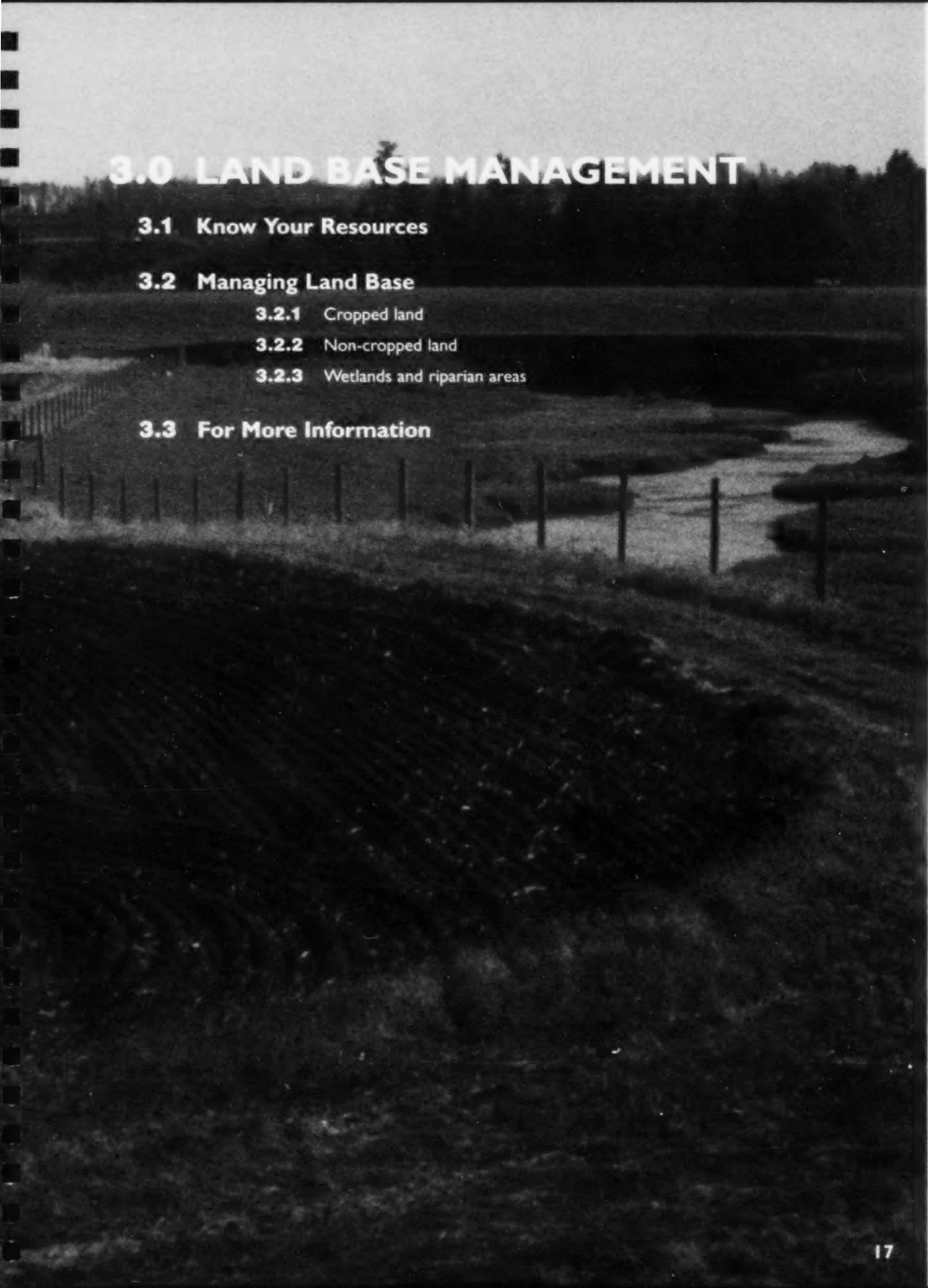
Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *A Primer on Water Quality: Agricultural Impacts on Water Quality.*
- *Managing Phosphorus to Protect Water Quality.*
- *Greenhouse Gas Emissions from Livestock in Alberta.*
- *GHG Emissions from Livestock in Alberta: Past, Present and Future.*
- *Impacts of Agriculture on Surface Water Quality in Alberta. Part I: Haynes Creek Study.*

Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration (AAFC-PFRA)
www.agr.gc.ca/pfra
AAFC-PFRA district offices:

Hanna	(403) 854-4448
Lethbridge	(403) 327-4340
Medicine Hat	(403) 526-2429
Peace River	(780) 624-3386
Red Deer	(403) 340-4290
Vegreville	(780) 632-2919
Westlock	(780) 349-3963
Dawson Creek	(250) 782-3116

- *The Health of our Air: Toward Sustainable Agriculture in Canada.*
- *The Health of our Soils: Toward Sustainable Agriculture in Canada.*
- *The Health of our Water: Toward Sustainable Agriculture in Canada.*
- *Nutrient Management Planning.*
- *Riparian Area Management.*
- *Soil Texture and Water Quality.*



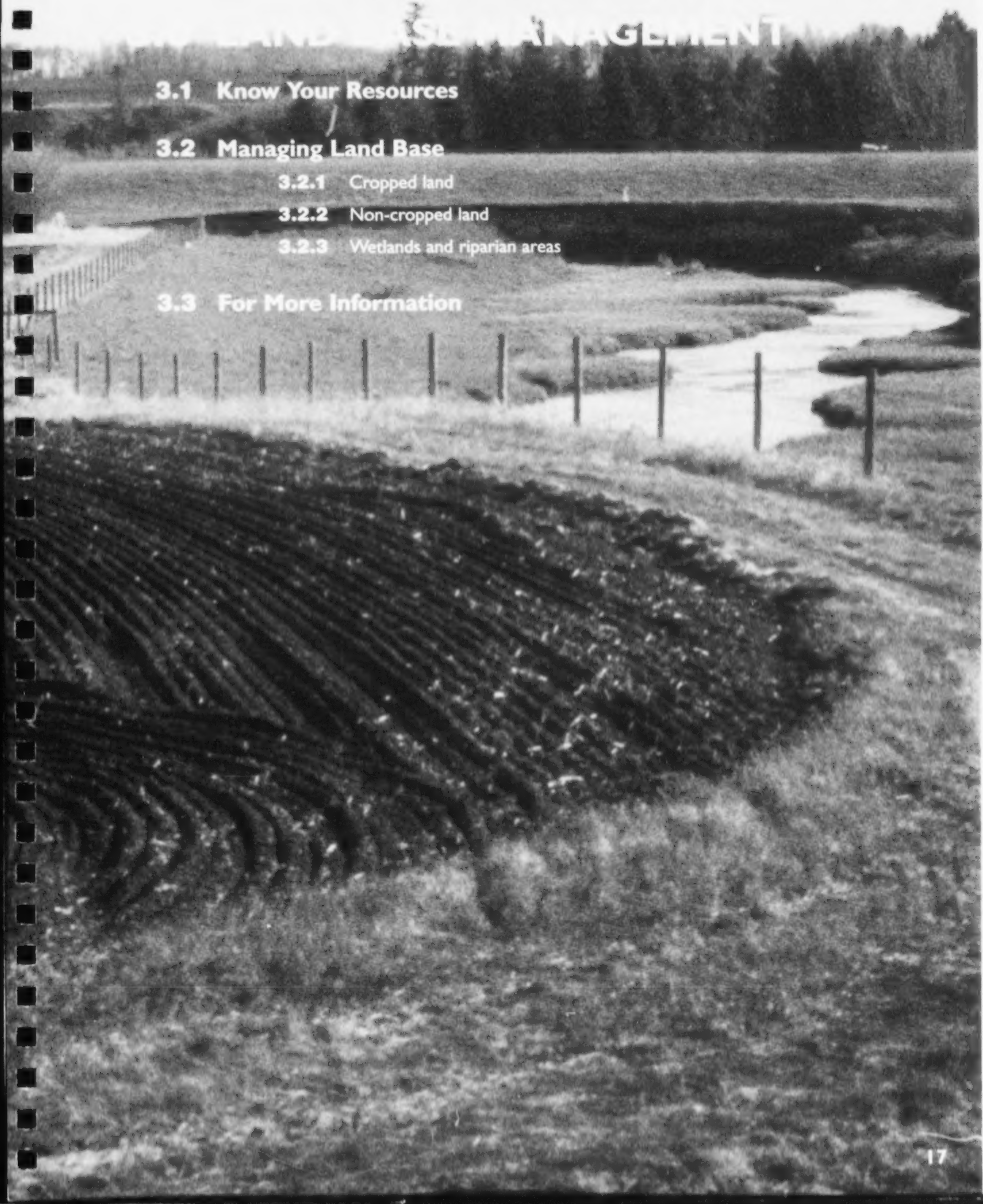
3.0 LAND BASE MANAGEMENT

3.1 Know Your Resources

3.2 Managing Land Base
  3.2.1 Cropped land
  3.2.2 Non-cropped land
  3.2.3 Wetlands and riparian areas

3.3 For More Information

3.0 LAND BASE MANAGEMENT



3.1 Know Your Resources

3.2 Managing Land Base

- **3.2.1** Cropped land
- **3.2.2** Non-cropped land
- **3.2.3** Wetlands and riparian areas

3.3 For More Information

3.0 LAND BASE MANAGEMENT

3.1 Know Your Resources

Understanding how farming and ranching practices affect the environment is an important part of sustainable, profitable livestock production. When and where cattle are placed on the land is important when considering the environmental health of the land base. By understanding how agricultural operations fit into the bigger picture, producers can identify problems and apply common sense solutions that will improve landscape health and increase productivity.

Maintaining a healthy landscape is everyone's responsibility. Food, water and shelter are the essential components of life for all living things. A healthy landscape supports agricultural activities while providing these essential components.

The first step in ensuring a healthy landscape is to evaluate the farming operation. It is valuable to know the soil conditions and natural vegetation of the farm before it was converted to agricultural use in order to assess its various habitats.

Producers can improve the health of their operation's landscape by:
- Maintaining what they have.
- Improving what they have.
- Restoring sensitive areas that have been converted to agricultural use (i.e. intermittently wet areas and treed areas).

Improving the health of the landscape can be simple - such as retaining existing treed areas or adding fall-seeded cereals to a crop rotation, or more involved - such as planting natural areas to link existing habitats so animals can travel safely between these areas.

3.2 Managing Land Base

This section provides options for enhancing the three main types of farm habitat: cropped land, non-cropped land, and wetlands and riparian areas.

3.2.1 Cropped land

Cropped land includes lands where native plant species have been removed and replaced with domestic annual or perennial plant species.

Cropped lands can provide shelter and food for ground-nesting birds and small mammals.

To improve habitat on cropped land:
- Convert lands that are marginally productive for annual crops into better-suited long-term forage production.
- Add perennial or annual forages to the crop rotation. Manage perennial forage stands for longer life.
- Use a flushing bar to flush out wildlife when haying.
- Cut hay on centre pivot, from inside-to-outside.
- Delay haying near wetlands to reduce nesting losses of ground-nesting birds. Wait until at least July 1, and whenever possible, delay until mid-July when bird nesting is usually near completion.
- Use direct-seeded fall crops.
- Reduce tillage to increase the diversity of soil life (e.g. earthworms and mycorrhiza).
- Eliminate fall tillage to maintain cover and provide food for wildlife during the winter.
- Use strip cropping instead of conventional fallow.
- Use integrated pest management to minimize harm to non-target species.

3.2.2 Non-cropped land

Non-cropped land includes native hayland, native pasture, shelterbelts, woodlots, bush, abandoned farmsteads and field borders. This land often has patches of native plants that are beneficial to wildlife.

To improve habitat on non-cropped land:

- Retain existing natural areas.
- Enhance the habitat value of treed areas, including shelterbelts, by adding fruit and nut-producing trees and shrubs, and leaving dead trees.
- Provide or retain corridors, such as fencelines and shelterbelts, between key habitat areas to provide shelter for wildlife moving between these areas.
- Use a flushing bar when haying. Delay haying near wet areas until mid-July when bird nesting is usually near completion.
- Avoid overgrazing and delay spring grazing near wet areas to minimize damage to soil and nests.
- Enhance the habitat value of idle areas such as field borders and abandoned farmyards by planting a variety of grasses, legumes, shrubs or trees, and adding nesting boxes.
- Maintain vegetative buffers between uncropped lands and wetlands because these areas contain additional diverse food and cover.
- Manage the farm's dog and cat populations to minimize excessive impact on non-pest species.

3.2.3 Wetlands and riparian areas

Wetlands are covered by water for all or part of the year. These moist conditions influence soil characteristics and support water-loving plants. Healthy wetlands and riparian areas reduce flooding, prevent erosion, protect water quality and provide wildlife habitat.

To improve habitat in wetland and riparian areas:

- Retain temporary wetlands. Small spring ponds provide important early spring breeding habitat for wildlife.
- Grow perennial forages for hay in wet areas.
- Protect vegetative buffers adjacent to riparian areas.
- Maintain, restore or enhance riparian vegetation (trees, shrubs and forages) to provide:
  - Breeding, feeding, nesting, travel corridors and cover for bird species and wildlife.
  - Shade, which regulates temperature for improved fish habitat.
- Use a flushing bar when haying. Delay mowing and haying of grassed waterways and other wet areas until mid-July when bird nesting is usually near completion.

3.3 For More Information

Contact the following offices for the publications listed or for more information.

Cows and Fish
(403) 381-5538
www.cowsandfish.org
- *Caring for the Green Zone.*
- *Biodiversity and Riparian Areas.*
- *Value of Wetlands.*

Alberta Environment
(780) 944-0313
www.gov.ab.ca/env
- *Focus on Wetlands.*

Environment Canada
(780) 951-8600
www.ec.gc.ca
- *Hinterland Who's Who Series.*

North American Waterfowl Management Program
(780) 489-2002
www.nawmp.ab.ca/programs.html
- *NAWMP Programs: Flushing Bar.*

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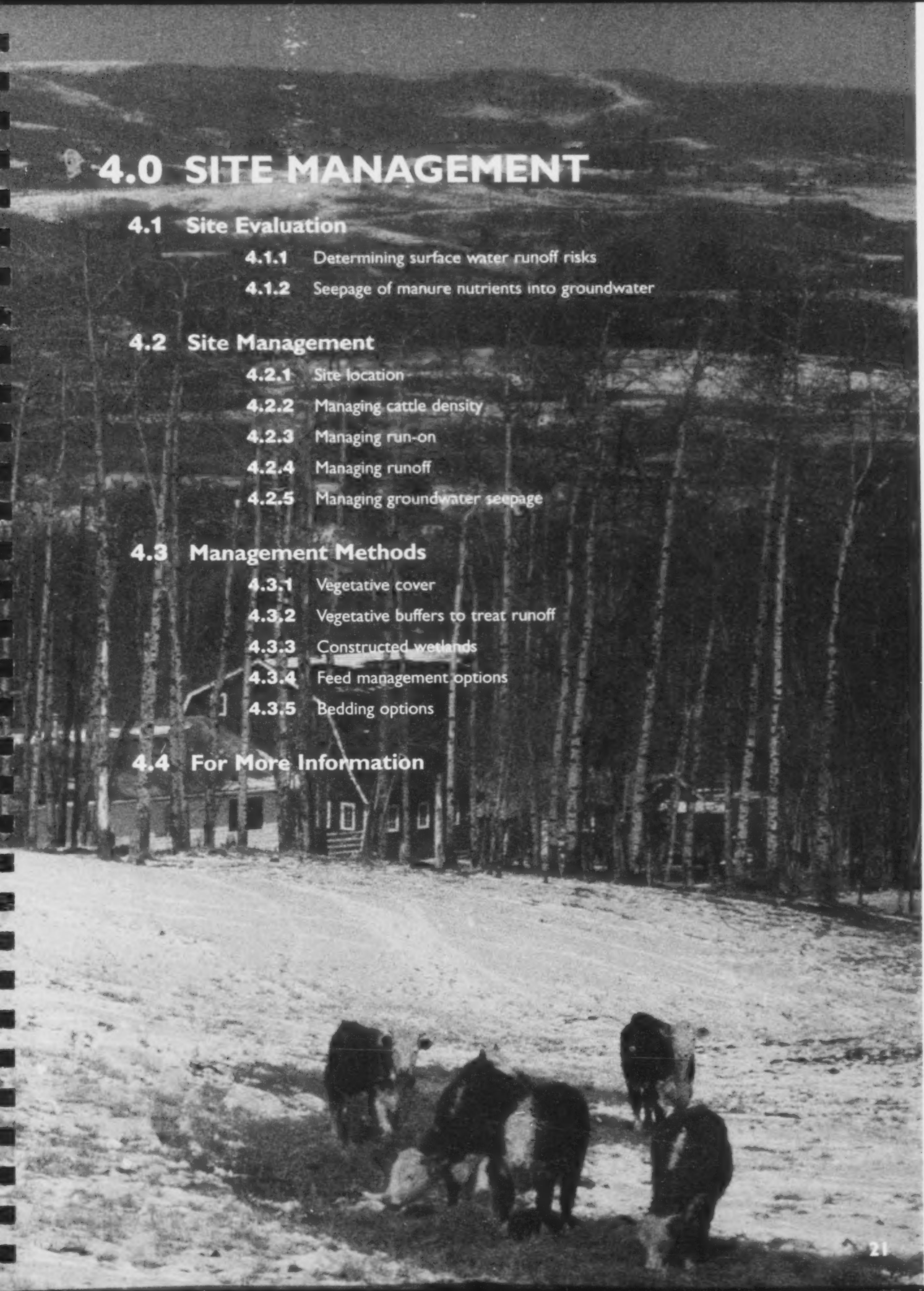


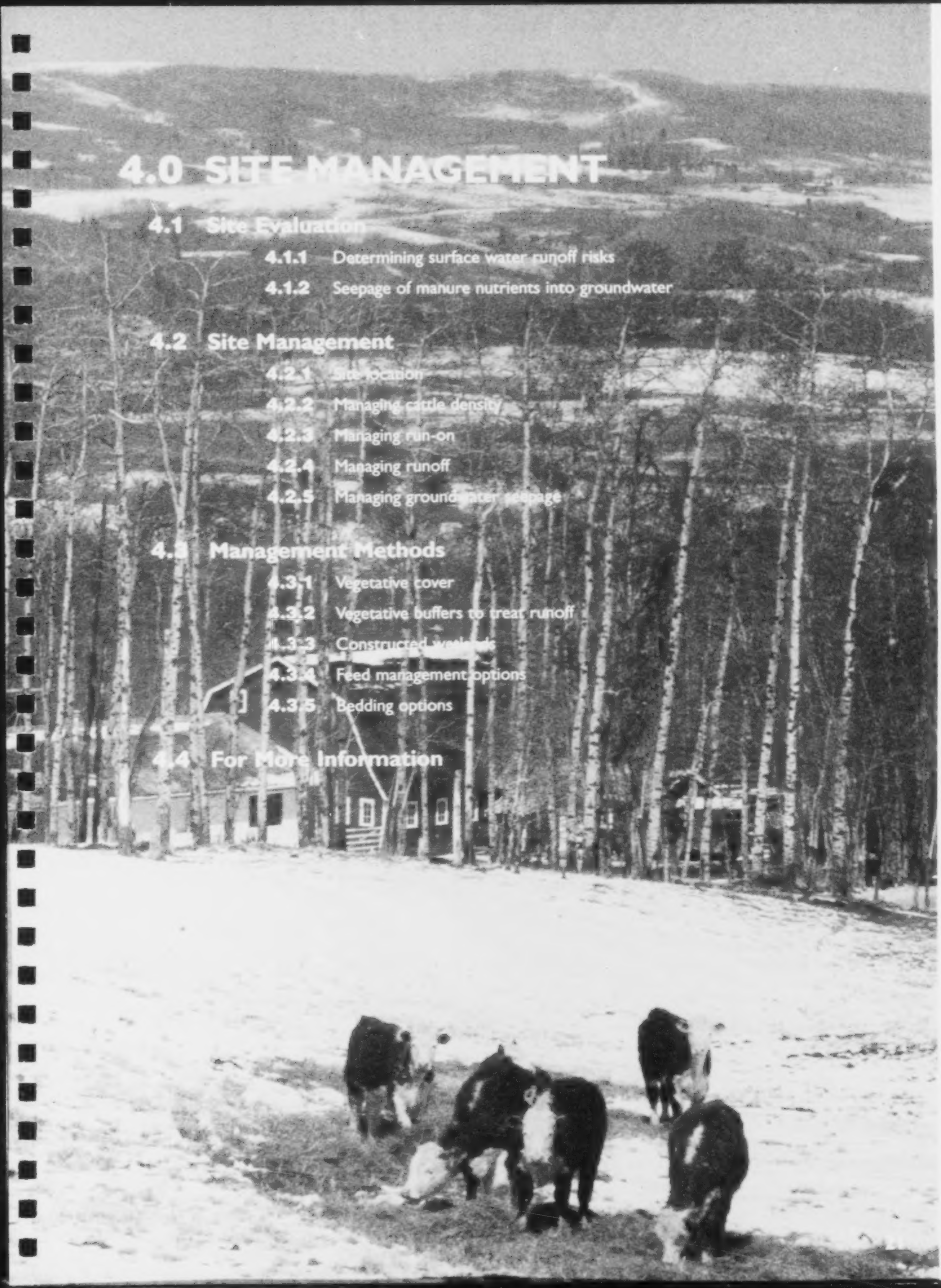
4.0 SITE MANAGEMENT

4.1 Site Evaluation
  4.1.1 Determining surface water runoff risks
  4.1.2 Seepage of manure nutrients into groundwater

4.2 Site Management
  4.2.1 Site location
  4.2.2 Managing cattle density
  4.2.3 Managing run-on
  4.2.4 Managing runoff
  4.2.5 Managing groundwater seepage

4.3 Management Methods
  4.3.1 Vegetative cover
  4.3.2 Vegetative buffers to treat runoff
  4.3.3 Constructed wetlands
  4.3.4 Feed management options
  4.3.5 Bedding options

4.4 For More Information



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4.4 For More Information

4.0 SITE MANAGEMENT

Alberta cattle producers need to consider the environmental impacts, legislative requirements and economic practicality of the location of their cattle operations. Generally cow/calf operations are situated where cattle can access shelter, feed and water. The improper management of cow/calf operations has the potential to damage riparian areas, decrease water quality and increase soil erosion. It can also result in lower productivity on the operation and damage the natural habitat of the area.

Cow/calf producers rely on a variety of sites for their operations, including summer pasture and wintering sites. The management of wintering sites and manure storage is regulated by the *Agricultural Operation Practices Act* (AOPA). Regardless of whether a permit is required under AOPA, cow/calf operators must follow AOPA regulations. In this section the focus is specifically on pasture and wintering sites.

Successful cow/calf operations plan for the short and long term, and also leave room for future expansion. Producers should consider AOPA regulations during their site selection as any future expansion may fall within the Act's regulatory requirements.

4.1 Site Evaluation

When evaluating a new or existing site, producers need to determine the environmental risks inherent to that site. They must also consider the site's potential impact on neighbours and the legal requirements. Environmental risks are determined by examining the site's topography, soil, and proximity to surface and groundwater. Producers can minimize potential conflicts with neighbours by keeping them informed of operational activities, and any development or expansion plans with open, honest discussion.

Pathways of Nutrient Movement to Water

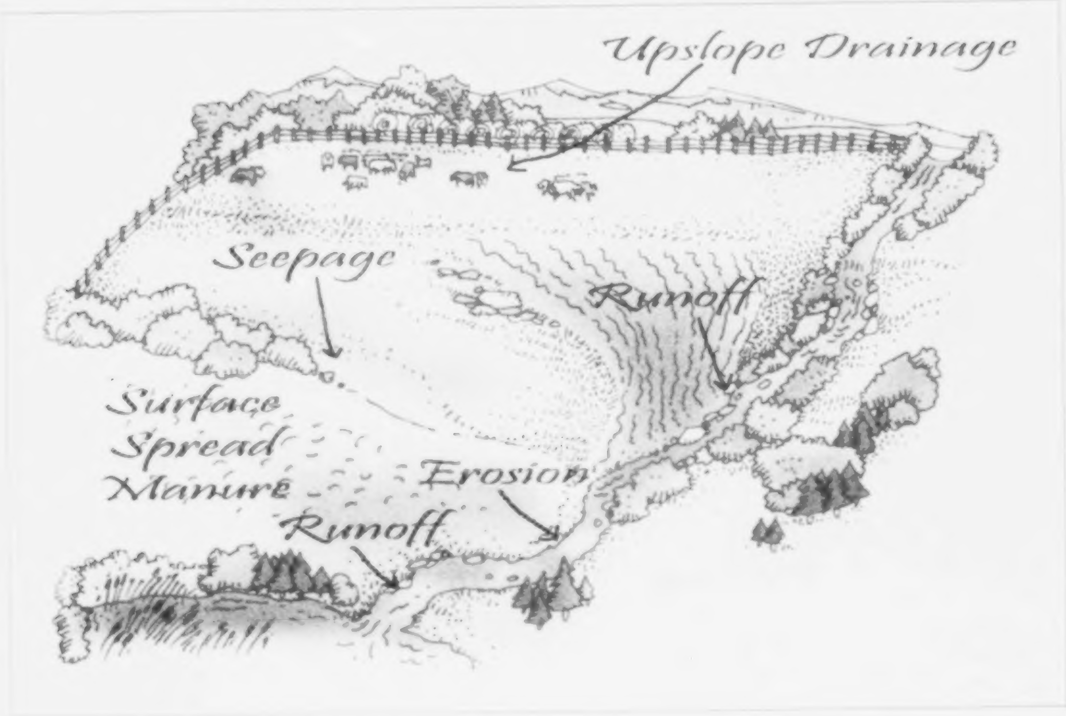

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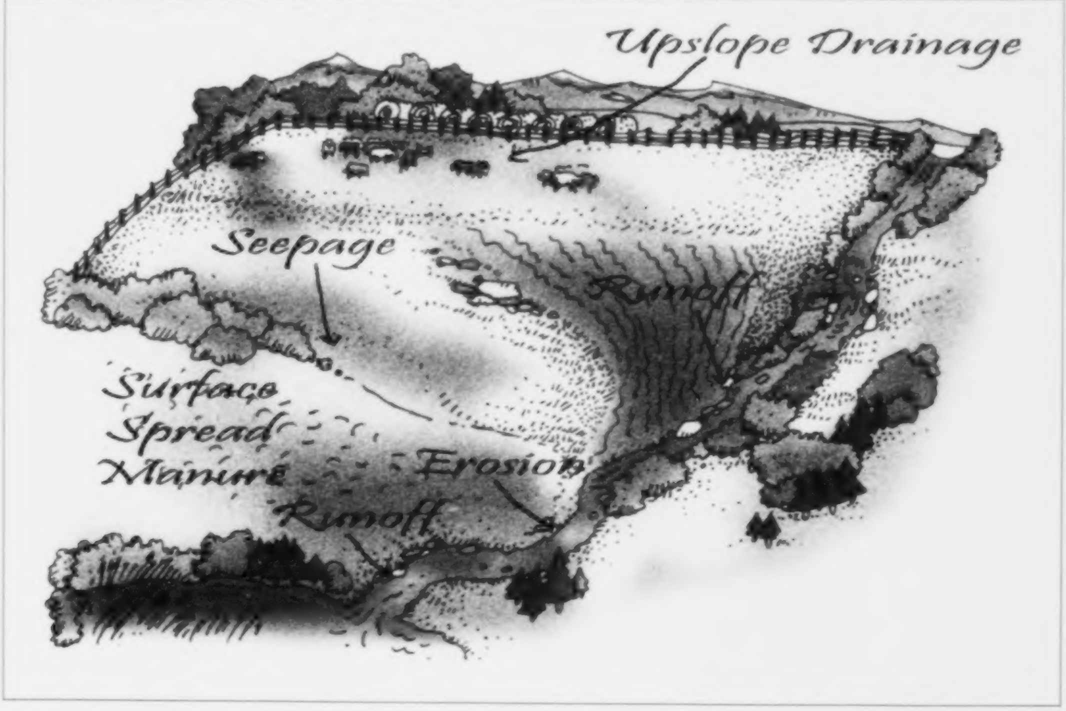
Figure 4.1 **Pathways of Nutrient Movement to Water**



4.1.1 Determining surface water runoff risks

It is important to determine the runoff risks of new or existing cow/calf operations. The following factors determine runoff risk:

Slope
The steeper the slope, the more unstable the soil will be. On a steep slope, the velocity of runoff water increases and the water carries more material.

Precipitation/climate
The greater the amount and intensity of rainfall and snowmelt, the greater the risk of water erosion.

Soil drainage/type
Fine (clay) to medium (silt) textured soils are more prone to erosion than coarser (sand) soils.

Surface water entering the feeding area
Clean water flowing from areas upslope of the site will increase the volume of manure runoff.

Vegetative cover
Soils covered by plants and plant residues will be less susceptible to water erosion than bare soil. Vegetative matter slows the flow of runoff.

Flood hazard
Locating wintering sites in high flood risk areas increases the chances of contaminated runoff.

It is also important to recognize situations where the rate of snowmelt is affected by site characteristics. For example, the shade from tall trees on the perimeter of a site may slow snowmelt and runoff, but an open slope facing south will be the first area to melt.

4.1.2 Seepage of manure nutrients into groundwater

Seepage can occur where runoff collects and stands. Manure stockpiles, wetlands and silage storage areas are all potential seepage sites. The risk of seepage is high in a wintering site. While the soil is frozen most of the time the bedding and feeding site is in use, in late spring the risk for manure nutrients leaching into the groundwater increases as the ground thaws.

4.2 Site Management

While some physical properties of a site, such as slope, soil type, water table and climate, may be beyond a producer's control, other factors can be managed. Properties that can be managed include water supply, cattle density, run-on and runoff. In the case of wintering sites, certain feeding and bedding strategies can minimize environmental risk. Section 5 deals with water supply alternatives for both pasture and wintering sites, and Section 7 discusses the management of cattle density on a pasture site. This section covers the management of cattle density on a wintering site, as well as the management of run-on and runoff.

4.2.1 Site location

Wintering sites.
If used properly, seasonal feeding and bedding sites, and wintering sites can be excellent ways to manage manure.

Locate or design wintering sites to protect surface water from manure contamination. These sites must be at least 30 metres from a common body of water. In cases where the sites are less than 30 metres from water, construct a properly designed berm between the site and the water to divert runoff, or remove accumulations of manure and bedding to an appropriate site before runoff occurs. Berming upslope of the site will divert clean run-on water and reduce the amount of manure runoff.

Use wintering sites only for short periods of time and in conjunction with an extended grazing program.

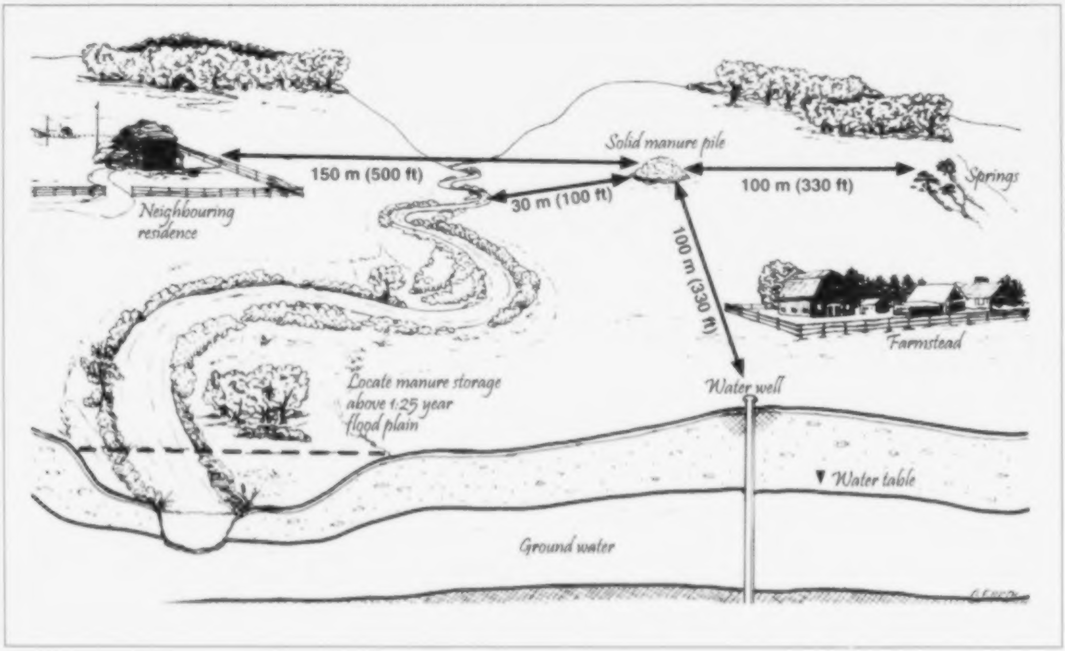
Short-term solid manure storage.
Environmental factors must be considered if manure is stockpiled for short periods of time (under seven months) before it is spread. Take into account safety concerns and relevant municipal bylaws.

Short-term storage of solid manure is regulated. It must be located:

- More than 150 metres from the nearest residence not under the producer's control.
- More than one metre above the water table.
- Above the 1:25 year flood plain.
- 100 metres from springs and water wells.
- 30 metres from a common body of water.

If a site does not meet the last two requirements, then the natural drainage of the site must slope away from the common body of water, or a properly designed berm between the site and the body of water must be constructed.

Figure 4.2 **Pathways of Nutrient Movement to Water**



4.2.2 Managing cattle density

High cattle density may have a negative effect on several of the runoff factors for cow/calf sites. Minimize manure buildup by spreading cattle out over a larger area of land by changing feeding locations and bedding sites, moving the salt and mineral supplies and, if possible, varying the access to water supplies.

4.2.3 Managing run-on

Run-on is surface water flowing from an upslope location.

When selecting from upland sources, consider spring snowmelt from sources such as shelterbelts and windbreaks in order to avoid run-on problems. Ditch or dyke upslope of the area to prevent surface water from entering the wintering site during spring runoff. This reduces the volume of runoff and the risk of surface water contamination. Reducing the volume of water on the site will limit mud problems and associated livestock health risks, as well as bedding requirements.

4.2.4 Managing runoff

Surface runoff is one of the factors that can be managed on a wintering site. Environmental impact can be minimized by containing or treating runoff.

4.2.5 Managing groundwater seepage

To minimize the potential of nutrients leaching into the groundwater, remove bedding piles before spring thaw and store at a short-term storage site. Do not spread until after the ground has thawed in spring. This also reduces the risk of disease transmission if the same site is used every year.

To manage seepage:

- Avoid areas with a high water table.
- Avoid sites with very porous soils, such as sand, gravel, shale or sandstone outcroppings.
- Choose sites with clay soils, which have the least infiltration.
- Avoid groundwater recharge areas.
- On porous soils, increase the feeding area per animal to reduce manure concentration.
- For wintering sites, move the feeding site and bedding pack regularly during the winter to minimize manure buildup and reduce the incidence of calf diseases.
- Move manure to a short-term storage area before snowmelt to prevent the movement of nutrients into the soil. After thaw, spread the manure on the land as fertilizer.
- Harrow the feeding and bedding area in the spring to disperse manure and straw.
- Decommission abandoned wells properly.

A water well or an abandoned well can act as a direct pathway to an aquifer. Ensure that the well is properly constructed in an upslope location, that runoff is diverted around it and that surrounding activities do not have the potential to contaminate the well water. Also, ensure that abandoned wells are decommissioned correctly to prevent contamination of the aquifer.

4.3 Management Methods

Various management methods can minimize an operation's impact on the environment.

4.3.1 Vegetative cover

The vegetative cover on winter and summer sites affects the flow of runoff. It is of particular importance on a wintering site, as runoff occurs in late winter and early spring long after hoof action has reduced the beneficial effect of residue. Vegetative cover or tall crop residue (15 centimetres in a slightly-sloped area is adequate; more stubble height and residue may be required if the slope is greater), combined with a sufficient buffer (30 metres or more) between the wintering site and the watercourse greatly reduces the risk of water pollution.

4.3.2 Vegetative buffers to treat runoff

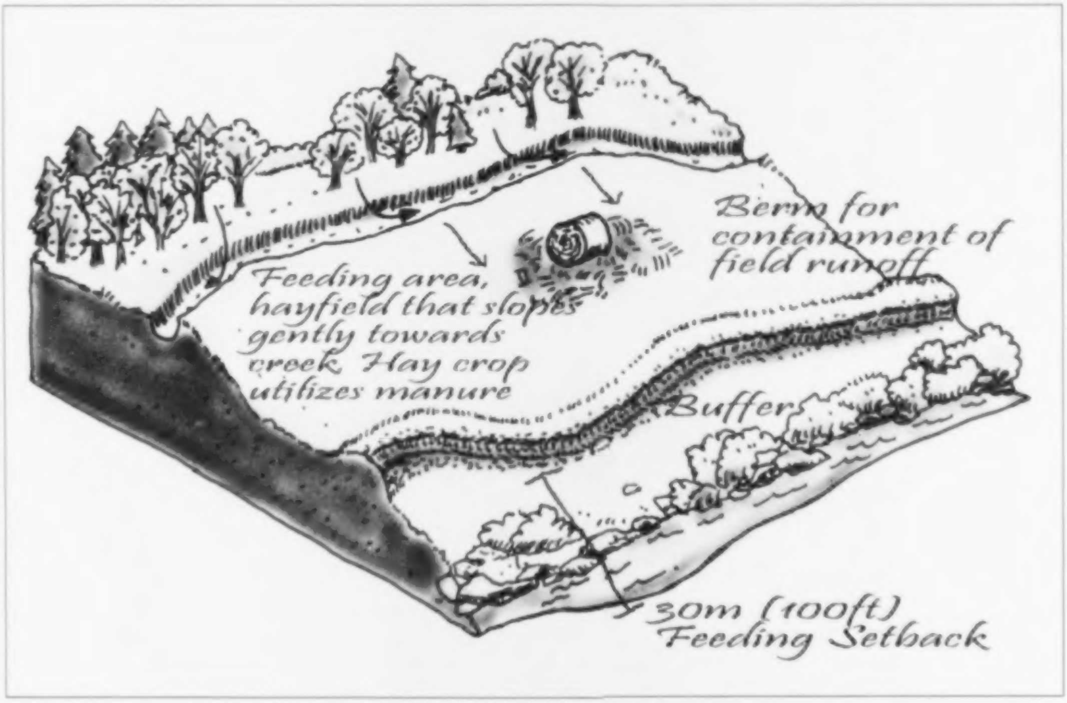
Use a variety of buffers to treat runoff from cow/calf sites. Vegetative filters, such as hayland, pastures with sufficient litter and stubble residue, grassed waterways, treed areas with grass ground cover and cropland with standing stubble, can all be used to dilute and slow runoff. A combination of settling, filtration, dilution, absorption, infiltration and nutrient uptake by plants contribute to the treatment process. Vegetative filter strips are widths or lengths of vegetation that act as a "filter" to trap and use sediments and nutrients from runoff. Manage these properly to prevent excessive nutrient buildup. Management includes harvesting the mature crop.

Vegetative filter strips may be sufficient to minimize runoff contamination from winter feeding sites, calving pens, manure stockpiles and from manure that is spread on cultivated fields.

A number of factors influence the effectiveness of vegetative filters. These factors include:

- Size of the contributing area (area of the feeding/bedding site, assuming upslope runoff is diverted).
- Manure concentration in the contributing area (area per animal unit).
- Amount of precipitation over a given time period, for a given location.
- Slope of the contributing area (increased slope results in increased runoff).
- Slope of the filter strip area and whether the topography lends itself to sheet or channel runoff.
- Soil type in the filter strip (for example, sandy versus clay), and its temperature and moisture content (frozen versus thawed; saturated versus non-saturated).
- Type, density, stability and nutrient uptake of the vegetation in the filter strip (summerfallow, stubble, grass, shrubs, trees). Stem size, stiffness and density affect sediment trapping, adsorption and erosion, while plant variety and species affect nutrient uptake.

Figure 4.3 **Run-on and Runoff Controls**


Berm for containment of field runoff
Feeding area, hayfield that slopes gently towards creek. Hay crop utilizes manure
Buffer
30m (100ft) Feeding Setback

4.3.3 Constructed wetlands

Constructed or manmade wetlands can be used to collect and treat contaminated runoff or discharge from livestock operations. Research is currently underway to develop design criteria for Alberta conditions.

To design and develop a wetland for effective wastewater treatment, it is necessary to understand the processes that occur in wetlands. Primary processes include:

- Uptake and transformation of nutrients by micro-organisms and plants.
- Breakdown and transformation of nutrients by micro-organisms and plants.
- Filtration and chemical precipitation through contact with plants and soil.
- Settling of suspended particles.
- Absorption and ion exchange on the surfaces of plants, sediment and litter.
- Predation and natural death of pathogens.
- Periodic harvesting of wetland plant material to prevent wetland nutrient overload.

Livestock producers must consider the advantages and limitations of such a system to determine whether a constructed wetland is suitable for their operation.

ADVANTAGES OF A CONSTRUCTED WETLAND:

Provides a high level of treatment. Test results show that phosphorus, nitrate-nitrites, ammonia, biological oxygen demand (BOD) and suspended solids can be reduced to acceptable levels.

Can be relatively inexpensive to construct. A site with accommodating specifications keeps establishment costs low.

Inexpensive to operate. A well-designed wetland transfers water through the system. Once established, properly designed and constructed wetlands are largely self-maintaining. Costs can be offset by harvesting forage from the area.

Reduces, if not completely eliminates, odour. Unlike lagoons, research shows that odours from wetlands are minimal or non-existent.

Handles variable wastewater loadings. Properly-designed wetlands show tolerance for varying amounts of wastewater loading.

Reduces the land area needed for wastewater application. Constructed wetlands reduce the concentration of contaminants, and therefore, the land area needed for wastewater application.

Aesthetically pleasing. Constructed wetlands enhance the landscape with colour, texture and plant variety.

Provides wildlife habitats. Wetlands attract wildlife and can improve the usefulness and attractiveness of an area.

DISADVANTAGES OF A CONSTRUCTED WETLAND:

Requires a continuous water supply. Water must be added if the wastewater supply is insufficient for sustaining plant populations during dry periods.

Can be relatively expensive to construct. Changing the lay of the land, adding soil amendments, liners and/or incorporating pumps add extra cost.

Affected by seasonal weather conditions, which may reduce reliability. Seasonal weather conditions, such as cold and drought, reduce the effectiveness of the system.

Can be destroyed by an overload of solids or ammonia. High ammonia levels caused by inadequate removal of solids destroys plant life in the wetland.

Removes nutrients. Nutrients removed by the wetland system are unavailable for land application and crop production.

4.3.4 Feed management options

Manure buildup occurs in permanent feeding areas. Move feeding areas regularly to minimize manure buildup.

FEEDING OPTIONS:
- Deliver feed bales to a new spot each day.
- Relocate movable feed bunks or feeders.
- Move portable windbreaks.
- Extend the grazing season by using one of the feeding techniques listed below.

FEEDING TECHNIQUES INCLUDE:

Swath grazing
- Cut annual or perennial forage crops and place in windrows to use when supplemental animal feed is required.
- Is most effective if feed wastage is controlled and swath consumption is matched to animal needs.
- Use an electric fence to ration feed intake.

Chaff utilization
- Attach chaff saver equipment to a combine to collect fine particle waste during grain harvesting for use later as animal feed.
- Allow cows to graze chaff piles in the field.
- Ration by using an electric fence, allow self-feeding from a large stack or mix with silage and deliver to animals.
- Chaff quality varies depending on combine settings and moisture, but usually has a higher value feed than straw.
- Chaff is a good supplement in cow maintenance rations.

Stockpiled forages
- Stockpiled or banked forages are unharvested standing perennial forages on pasture or hay fields that are left for grazing at later times.
- Plant growing season is often not the same as the grazing season.
- The annual period of plant growth and mass of growth available at any point in time is controlled by the environment, plant and management.
- Animal grazing of this standing material can be extended into periods when growth is slow or plants are dormant. In order for this to occur, forage yield must be budgeted for periods of the growing season.
- Costs are equivalent to values for summer pasturing, which is usually less than half of hay or silage feeding costs.

Bale grazing
- Feed bales in the field or pasture as an alternative to delivering feed to cows daily.
- Manage waste by limiting access to bales.
- Bales can be grazed where they dropped from the baler or they can be hauled to another location to meet feed requirements at specific times.

Figure 4.4a **Swath Grazing**

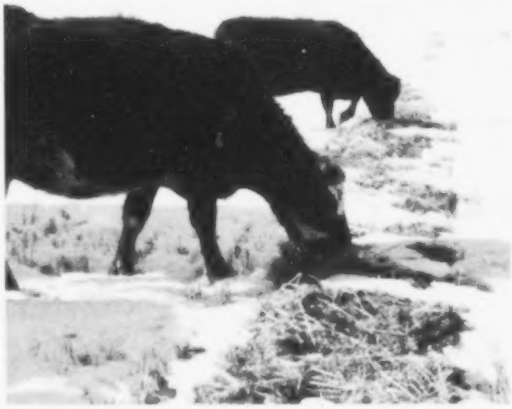


Figure 4.4b **Chaff Utilization**

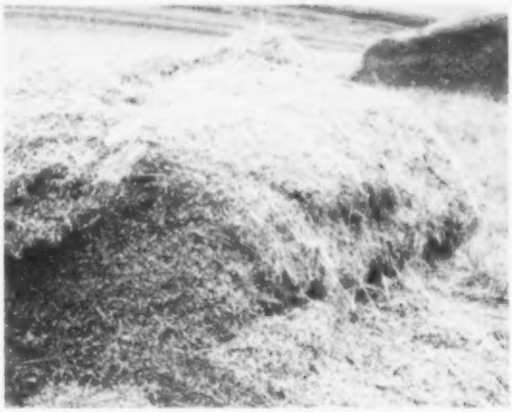
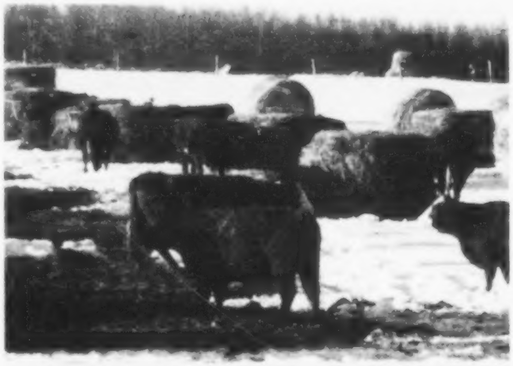


Figure 4.4c **Bale Grazing**



4.3.5 Bedding options

The majority of cow/calf operators use some form of bedding during the winter. However, some producers use other options and do not bed their cattle. If using bedding, plan the site to include several bedding areas and rotate them yearly. The following bedding options can minimize the accumulation of bedding material and manure.

Portable windbreaks. Manure buildup occurs around watering and bedding areas. To better manage the bedding area and minimize straw buildup, create sheltered windbreaks away from the water supply. Use 20 percent porosity fences, fenced or controlled shelterbelts, open front sheds or other structures. When combined with feeding options, portable windbreaks can encourage bedding site relocation. Periodic movement of the portable windbreaks minimizes manure accumulation in any one location.

Fencing. Cattle will seek shelter in treed or brush-covered areas. To minimize runoff and damage to vegetation, locate shelter areas away from a common body of water and related riparian areas. If wintering sites include riparian areas, then management options, such as fencing, should be used to control cattle movement.

Alternative bedding material. Bedding materials have different water absorption properties. Figure 4.6 provides water absorption capacity for common bedding materials.

Bedding methods. The following methods are beneficial for bedding cattle:

- Clear snow and spread bedding material on cleared area.
- Build a bedding pack that generates heat for the cattle.
- Provide clean snow and shelter for bedding animals.
- Clear snow on forage stubble with no additional bedding. Animals prefer bedding in forages with a thatch layer.

Figure 4.5 **Portable Windbreak**

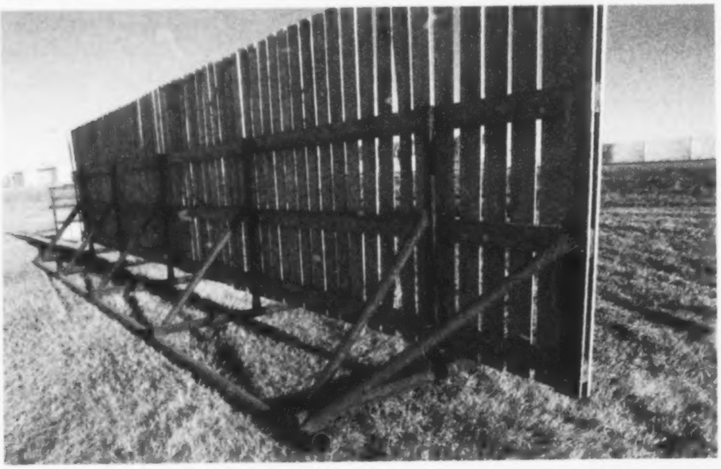


Figure 4.6 **Water Capacity of Common Bedding Material**

Material	Pounds of Water Absorbed per Pound of Bedding (Typically 10 percent moisture content)
Wheat straw	2.2
Oat straw	2.5
Barley straw	2.2
Shavings or sawdust	1.5

4.4 For More Information

Contact the following offices for the publications listed or for more information.

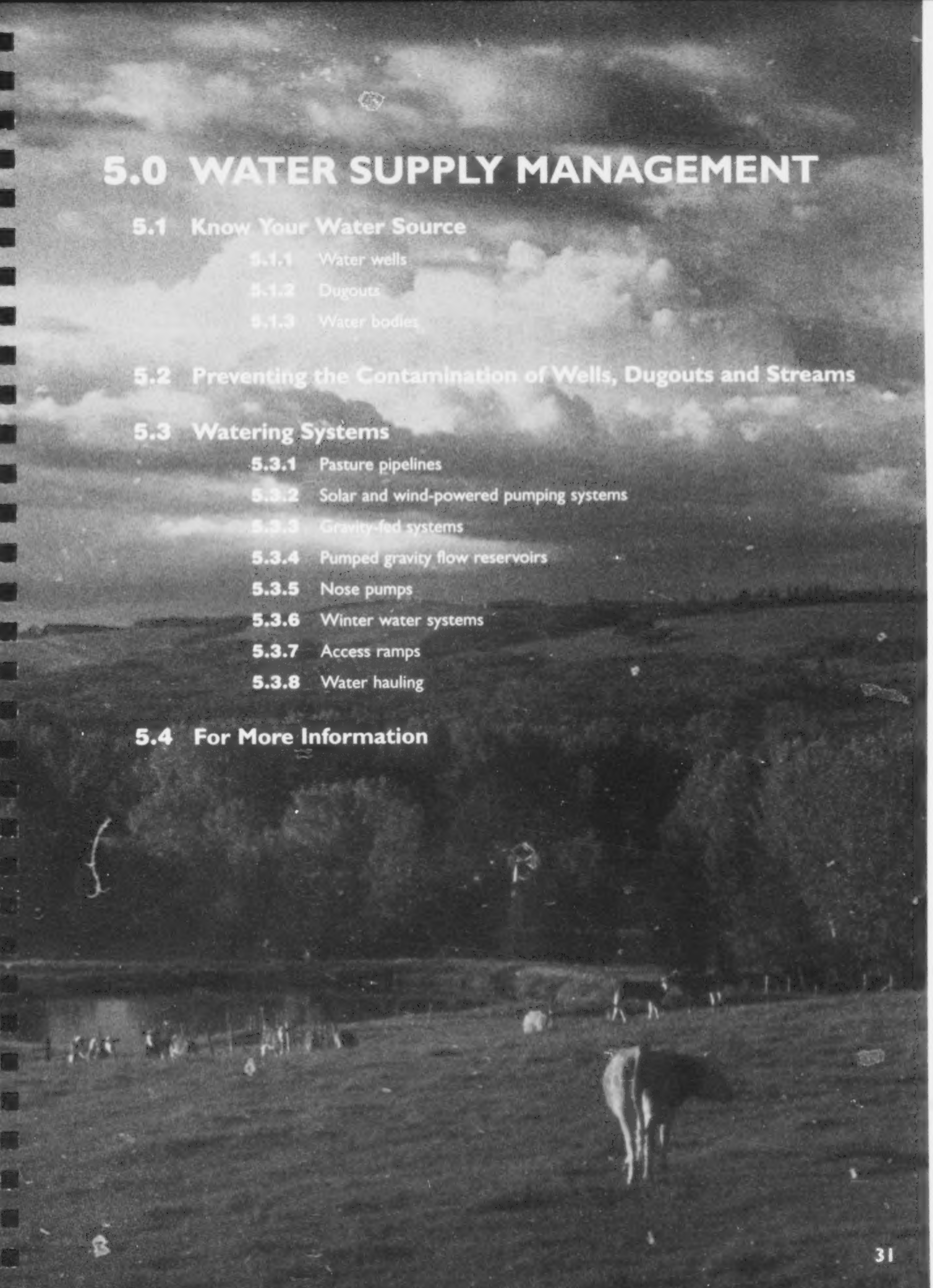
Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Alberta Feedlot Management Guide.*
- *Cattle Wintering Sites: Managing for Good Stewardship* Agdex 420/580-2.
- *An Introduction to Swath Grazing in Western Canada* Agdex 420/56-1.
- *The Standard: The Agricultural Operation Practices Act: How it Affects Cow-Calf Producers.*
- *Reference Guide: Agricultural Operation Practices Act.*

Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration (AAFC-PFRA)
www.agr.gc.ca/pfra
AAFC-PFRA District offices:

Hanna	(403) 854-4448
Lethbridge	(403) 327-4340
Medicine Hat	(403) 526-2429
Peace River	(780) 624-3386
Red Deer	(403) 340-4290
Vegreville	(780) 632-2919
Westlock	(780) 349-3963
Dawson Creek	(250) 782-3116

- *Constructed Wetlands for Feedlot Runoff and Treatment.*



5.0 WATER SUPPLY MANAGEMENT

5.1 Know Your Water Source
  5.1.1 Water wells
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  5.1.3 Water bodies

5.2 Preventing the Contamination of Wells, Dugouts and Streams

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  5.3.5 Nose pumps
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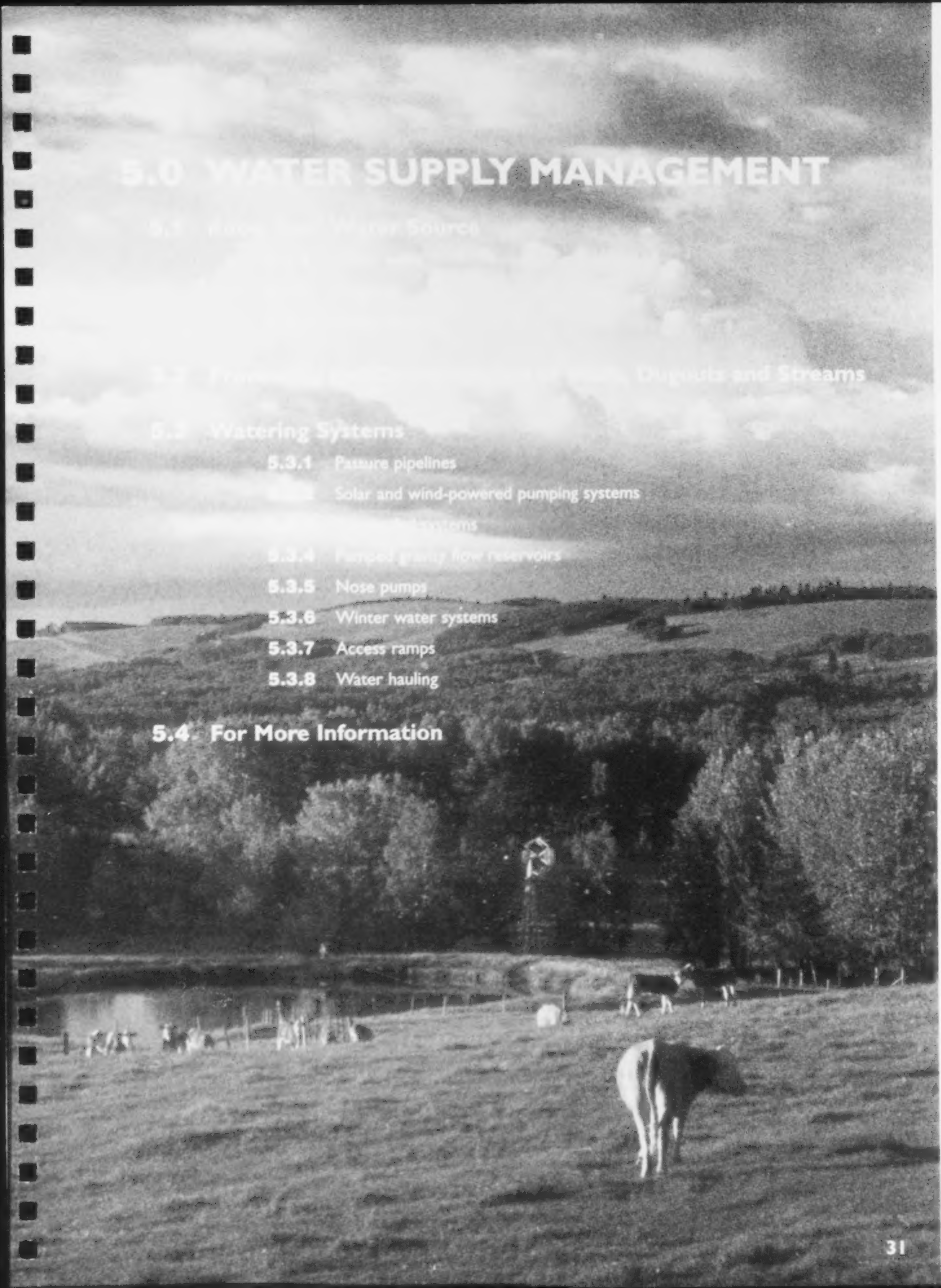
5.4 For More Information



5.0 WATER SUPPLY MANAGEMENT

5.1 Kno[illegible] [illegible] Water Source

5.2 Pro[illegible] [illegible] Dugouts and Streams

5.3 Watering Systems
    5.3.1 Pasture pipelines
    5.3.2 Solar and wind-powered pumping systems
    [illegible] [illegible] systems
    5.3.4 Pumped gravity flow reservoirs
    5.3.5 Nose pumps
    5.3.6 Winter water systems
    5.3.7 Access ramps
    5.3.8 Water hauling

5.4 For More Information

5.0 WATER SUPPLY MANAGEMENT

Site selection for cow/calf operations depends greatly on the availability of a reliable, clean water source for livestock. Water requirements vary with animal size, air temperature, diet, moisture content of the feed and water quality.

Water wells, dugouts, sloughs, streams and creeks are the most common sources of water. All water uses may be subject to licensing requirements by Alberta Environment. It is important to manage the water supply properly to ensure its longevity and quality.

The following are typical average water consumption rates recommended for cattle on pasture:
- Yearling steers or heifers – 40 litres per day (8 gallons per day).
- Cow/calf pairs – 60 litres per day (12 gallons per day).

These are average rates and on hot summer days, peak water consumption can be 1.5 times greater.

5.1 Know Your Water Source

5.1.1 Water wells

If using a well for livestock watering needs, ensure it can supply a consistent amount of good quality water. It is extremely important that the amount of water pumped from a well does not exceed the recharge capacity of the aquifer supplying the well. This can be determined by doing a pump test. If the capacity is exceeded, the groundwater will be "mined" and the operation will not be sustainable.

New wells drilled for any purpose other than household use will require a licence under the *Water Act*. To obtain a licence, contact Alberta Environment. Part of the licensing process requires proof that water supplies are adequate for the operation's needs. Also, the new water use must not have a negative impact on neighbouring household wells or wells that have a senior water licence.

For assistance with the initial assessment of groundwater potential, contact government agencies, such as Alberta Agriculture, Food and Rural Development (AAFRD) or Agriculture and Agri-Food Canada: Prairie Farm Rehabilitation Administration (PFRA), which have access to maps and water well data. Local water well drillers can also provide valuable information. In some situations, it is best to contact a professional hydrogeologist (under Engineering Consultants in the Yellow Pages). These consultants can assess the groundwater potential for the area, supervise the drilling and testing and prepare reports necessary for the licensing process. Alberta Environment has a sliding scale of requirements for licensing, depending on the amount of water used. **See the *Groundwater Evaluation Guideline* http://www3.gov.ab.ca/env/water/Legislation/Guidelines/GroundwaterEvaluation.pdf.**

The requirements for a typical pasture well (less than 11,000 litres/day) can usually be determined by a proper pump test done by the driller when the well is drilled, and a self-done survey of neighbouring wells. Once a licence is issued, the operation will have first priority on the water supply over any other user that applies for a licence later.

Note: According to the *Water Act*, the well must be constructed to Alberta Environment standards. The well may only tap into one aquifer and must have the casing sealed from the top of the aquifer to the surface.

For more detailed information on licensing, contact an Alberta Environment office through the Alberta Government toll-free line at 310-0000.

5.1.2 Dugouts

Dugouts are another option for supplying livestock with water. They are typically filled by collecting spring runoff or water from irrigation canals, creeks, rivers or lakes. Some dugouts are filled by groundwater. Groundwater-filled dugouts may pose a higher risk of groundwater contamination and should be managed accordingly.

The size of dugout required for a cow/calf operation varies with the water requirements of the operation, the refill frequency of the dugout, and assessments of seepage and ice thickness.

Dugouts that are only filled by spring runoff should be designed to hold at least a two-year water supply, unless an alternative source can be used to fill the dugout in a drought year. Dugouts in irrigated areas or dugouts adjacent to rivers or lakes must be at least large enough to supply water from the time the water is not available in the fall until water flows again in the spring. Planning and design information is available through PFRA or AAFRD water specialists.

Some dugouts may require licensing by Alberta Environment. Check with Alberta Environment to ensure that all legislative requirements are met when planning any of the following dugout types:

- Constructed in water body locations.
- Intercepting groundwater.
- Over 12,550 cubic metres in size.
- Using more than 6,250 cubic metres of water/year.

Water Act

A licence through the *Water Act* protects the licensee from other water users that may be competing for the same water. If a new water user (other than a household) has a negative impact on a cow/calf operation's water supply, the cow/calf operator will have priority for the licensed amount. When issuing a licence, Alberta Environment will ensure that the water use will not negatively affect other licensed users, household users or the watershed itself.

5.1.3 Water bodies

Water bodies are locations where water flows or is present year round or intermittently. They include lakes, wetlands, creeks and sloughs. Managing these waterways to ensure their health is key to a sustainable water supply. For more information on grazing practices to manage waterways and their associated riparian areas, see Section 7.

It is important to provide water to cattle at a location away from the water body. By minimizing the impact of livestock on wet, sensitive areas around a water body, water quality and quantity can be protected.

Benefits of maintaining the health of these areas include:

- Improves and maintains water quality. Wetlands filter and trap sediment, and reduce pollutants.
- Provides temporary storage for runoff water, to control downstream flooding and prevent soil erosion.
- Conserves and recharges groundwater and surface water supplies.
- Provides habitat for a variety of plants, birds, animals and fish that depend on water or wet soils to survive.
- Provides forage and shelter for livestock under managed conditions.

5.2 Preventing the Contamination of Wells, Dugouts and Streams

Alberta cow/calf producers must take a number of considerations into account when operating near a well, dugout or stream in order to prevent water contamination.

Wells

- Ensure wells are properly constructed and sealed.
- Locate wells upslope, away from sources of contamination.
- Decommission abandoned wells properly to prevent contamination of newer wells.
- Do not over-apply manure - nitrate seepage can contaminate groundwater.
- Construct manure storage structures so there will be no seepage into groundwater.

Dugouts

- Construct dugouts properly, adjacent to drainage areas and away from water runways and potential sources of contamination.
- Apply manure and fertilizers to meet crop nutrient needs. Ensure application is at least 30 metres from the dugout. Excess soil nutrients can lead to high nutrient levels in the runoff water, which causes increased algae and weed growth in dugout water.
- Contact a local AAFRD water specialist to develop a plan to protect the operation's water supply.

Streams

- Minimize the impact of cattle on streams and water ways for both summer and winter sites.
- Use offsite watering methods for better utilization of existing water sources.
- See Section 7.1.6 Riparian Pastures for information on managing a healthy riparian area.

5.3 Watering Systems

A variety of livestock watering methods are available for any type of pasture and location. Water can be moved to livestock using several options, including solar, wind, fuel, stream flow, mainline electricity and gravity flow. Selecting the most appropriate option can be a challenge.

Establish a list of priorities and use the natural advantages of the site and equipment.

Factors to consider:

- Type and location of available water source(s).
- Site location and conditions (remote location, topography, riparian features).
- Type of grazing system (intensive or extensive).
- Number of livestock.
- Access to power source (mainline power, solar, wind, animals, etc.).
- Pumping system (amount of lift, automated versus manual).
- Flexibility and portability.
- Reliability and maintenance.
- Temporary or seasonal water storage.
- Cost/benefit and cost/animal.
- Personal preference.
- Regulations.

5.3.1 Pasture pipelines

Often the most cost effective flexible water supply system is a pasture pipeline. If there is reliable water source, and power within one to two miles of the pasture, water can be delivered anywhere along that pipeline for a fraction of the cost of developing a new water source and pumping system.

Figure 5.1 **Pasture Pipelines**

5.3.2 Solar and wind-powered pumping systems

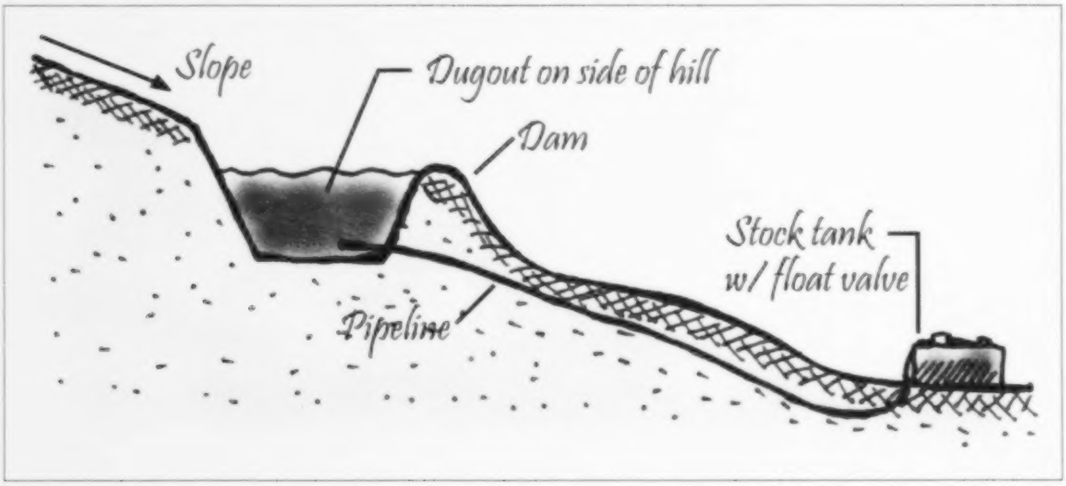
A number of solar and wind-powered pumping systems are available. It is important that these be sized to match the job. Costs can run from $1,000 to $10,000, depending how much water is needed and how high the water needs to be lifted from the source to the trough.

5.3.3 Gravity-fed systems

Gravity-fed systems are ideal for sloping pastureland where a dugout or dam can be located upslope from a watering site. A pipeline can be run from the dugout, downslope into a stock tank. As a rule, the water level in the dugout should be at least 1.5 metres higher than the stock tank plus 12 inches additional height for every 30 metres of pipeline to the stock tank (Figure 5.2).

Gravity-fed systems can also be used for springs where there is a sufficient elevation drop to the stock tank. On long, undulating and/or steep drops, take extra care to avoid pipeline leaks or air blockages. For assistance, contact a knowledgeable contractor or consultant.

Figure 5.2 **Gravity-fed System**



5.3.4 Pumped gravity flow reservoirs

Pumped gravity flow reservoirs are generally constructed by digging a small reservoir out of the dirt pile excavated from a dugout (similar to Figure 5.2). These can be constructed in a few hours with a standard backhoe. Line the reservoir with a woven polyethylene liner to prevent seepage and to keep the water clear. The reservoir bottom must be higher than the top of the stock tank. This approach will provide adequate gravity flow from the reservoir through the water line and float valve assembly and into the stock tank (Figure 5.2).

The proper size water line and high capacity, low pressure float valve are important to ensure adequate flow rates. Figure 5.4 shows the dimensions, water volumes and costs for a typical elevated earthen reservoir.

Figure 5.3 **Pumped Gravity Flow Reservoirs**

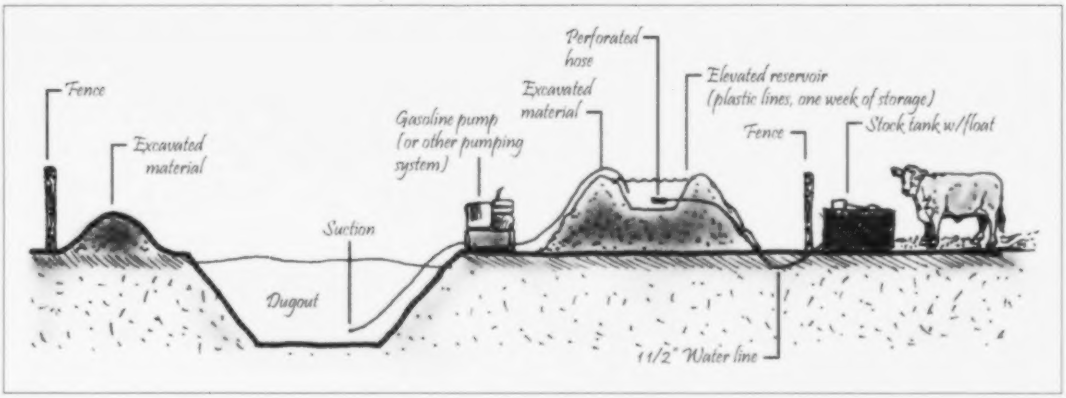

Fence
Excavated material
Suction
Dugout
Gasoline pump (or other pumping system)
Perforated hose
Excavated material
Elevated reservoir (plastic lines, one week of storage)
Fence
Stock tank w/float
11/2" Water line

Figure 5.4 **Elevated Earthen Reservoir Water Volume and Costs**

Reservoir Dimensions (ft.)		Approximate Water Volume	Estimated Costs of Reservoir and Plastic Liner
Top Length x Width x Depth	Bottom Length x Width	(Imperial Gallons)	
25 x 15 x 5	15 x 5	5,000	$350
35 x 15 x 5	25 x 5	10,000	$500
40 x 20 x 5	30 x 10	15,000	$650
45 x 20 x 5	35 x 10	20,000	$800
45 x 25 x 5	35 x 15	25,000	$1,000
45 x 45 x 5	35 x 35	50,000	$2,000

Note: The woven polyethlene liner used for estimating costs is 31 cents per square foot. Reservoir water volumes are calculated using side and end slopes of 1:1. Costs are based on 2000 prices.

5.3.5 Nose pumps

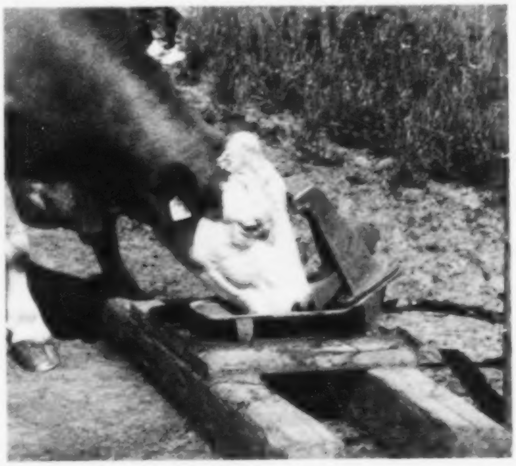
Nose pumps, if properly installed, can be a trouble-free way to supply livestock with clean water. The pump is low cost, approximately $10 per cow/calf pair. Each pump can be used for about 30 to 40 cow/calf pairs.

Several types of nose pumps are sold in Alberta; most are for summer use. They all supply approximately one litre of water for every stroke of the nose device. The pumps can lift water a maximum of six vertical metres, and with the use of a shallow buried pipeline, can be located half a kilometre or more from the water source.

Minimizing the elevation from the water supply makes it easier for cows and calves to operate the pump. Shallow pipeline burial is recommended once the best locations for the pumps have been determined.

These pasture pumps are very reliable and systems can be set up so they can be moved from pasture to pasture. However, cattle will take a day or so to learn how to operate the pump. This training period is best done at the farmyard after calving and before the cows go out on pasture. Calves will generally not learn to operate the pumps until they are about 300 pounds. There are several options to overcome this problem. One is to fill a stock tank with water and allow only calves to have access. Another option is to collect some of the water pumped by the cows into a small tub or stock tank for the calves to drink.

Figure 5.5 **Nose Pump**



5.3.6 Winter water systems

In the last few years, some producers have installed winterized pasture water systems in their wintering sites. With proper planning and design, almost all pasture water systems can be modified and used throughout the winter. Winterized solar powered systems and frost-free nose pumps, specifically designed for winter use, also work well.

5.3.7 Access ramps

An access ramp is the minimum improvement that can be made to a water source. Ramps are most appropriate for large herds of livestock in remote locations (i.e. rangeland pastures) where animals are seldom checked or moved, and where fencing that would prohibit cattle access is impractical. Reinforced ramps provide better footing for livestock drinking from dugouts, sloughs and streams in areas with soft soil.

Access ramps require a slope of 1.5 to 2 metres for every 30 centimetres of elevation. To construct the ramp, lay down a strip of crushed road gravel preferably with sizes from 2.5 centimetres of diameter down to 10 to 15 percent fines. The gravel layer should have a minimum thickness of 30 centimetres. Start the gravel layer 3 to 4.5 metres from the water's edge and continue down below the lowest water level of the dugout. Use a small bulldozer or four-wheel drive tractor to compact the gravel.

In most conditions, especially where there is soft soil, place a plastic polygrid or geogrid under the gravel to provide added support. The material comes in three or four-metre wide rolls and can be overlapped for wider ramps.

Since the water source is usually fenced, livestock can only drink from the access ramp. Some producers have found that fencing is not necessary, because once the cattle have convenient access to water, with good footing, they will water almost exclusively from the ramp.

5.3.8 Water hauling

In intensive livestock grazing, cattle are sometimes moved daily from pasture-to-pasture. Access to water is often the limiting factor. By using a truck with a main storage tank and a portable stock tank, the watering source can be continuously relocated throughout the pasture, along with the cattle. This constant relocation distributes nutrients from manure and urine more evenly in the field.

If any work is required on the bed and shores of a stream, contact Public Lands, Alberta Environment, the Department of Fisheries and Oceans and irrigation districts, where applicable. In some cases, these agencies will need to issue permits.

Public Lands Management Branch
Sustainable Resource Development
Contact the Shoreline Management Co-ordinator or a regional office of the Alberta Government through the toll-free line at 310-0000.

Alberta Environment
Contact a regional office through the Alberta Government toll-free line at 310-0000.

Department of Fisheries and Oceans Canada

Calgary	(403) 292-5160
Edmonton	(780) 495-4220
Lethbridge	(403) 394-2920
Peace River	(780) 618-3220

5.4 For More Information

Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Water Wells That Last Generations.*
- *Water Analysis Interpretation* Agdex 400/716-2.
- *Quality Farm Dugouts* Agdex 716.B01.
- *Dugouts for Farm Water Supplies* Agdex 716.B30.
- *Dugout Maintenance* Agdex 716.B31.
- *Seepage Control in Dugouts* Agdex 716.B32.
- *Float Suspended Intake* Agdex 716.B34.
- *Dugout Aeration With Compressed Air* Agdex 716. B36.
- *Hydrated Lime for Algae Control in Dugouts* Agdex 716.B37.
- *Pasture Systems for Livestock, 2001* Agdex 400/716-3.

Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration (AAFC-PFRA)
www.agr.gc.ca/pfra
AAFC-PFRA District offices:

Hanna	(403) 854-4448
Lethbridge	(403) 327-4340
Medicine Hat	(403) 526-2429
Peace River	(780) 624-3386
Red Deer	(403) 340-4290
Vegreville	(780) 632-2919
Westlock	(780) 349-3963
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- *Water Wells That Last Generations.*

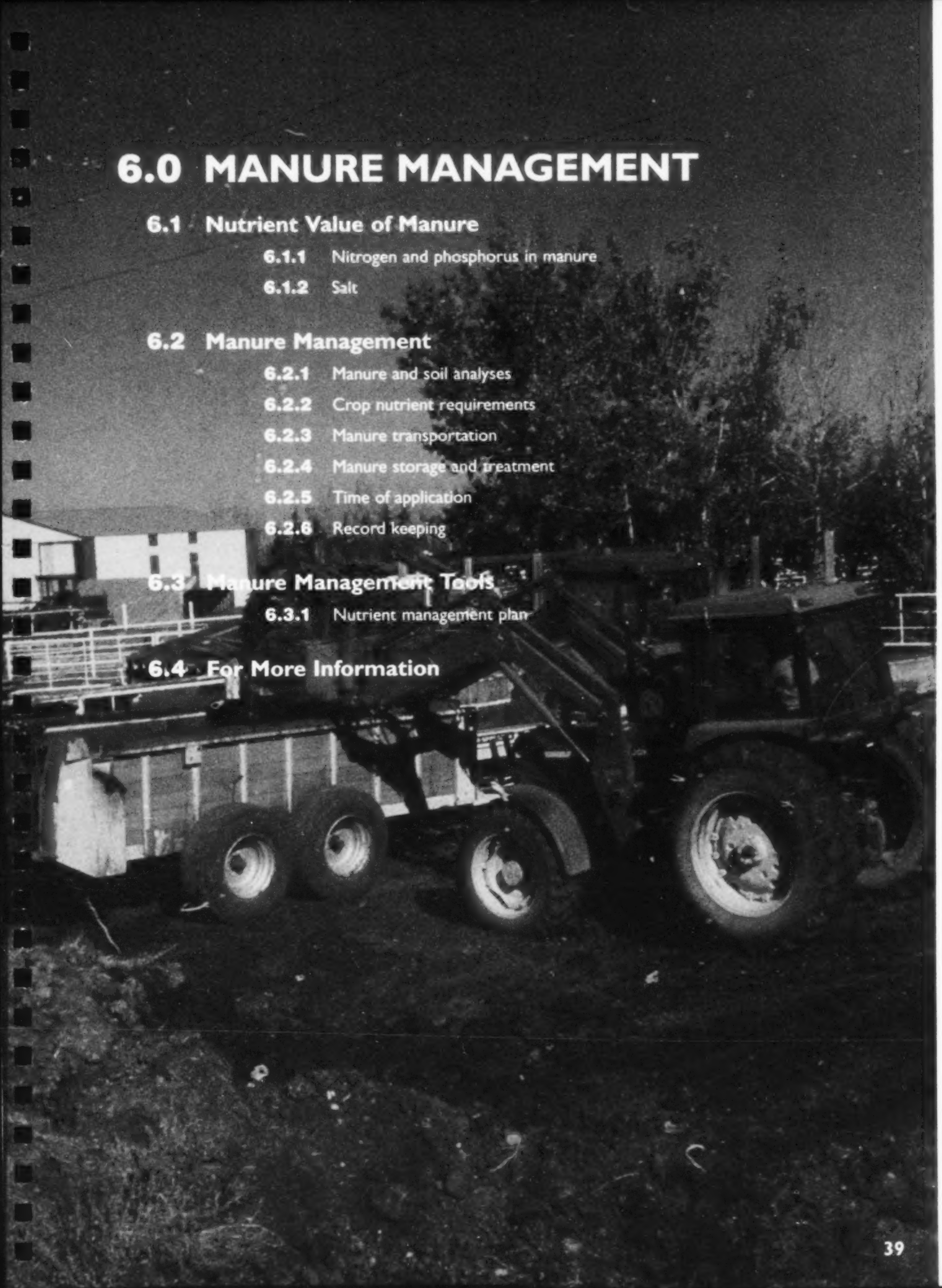
6.0 MANURE MANAGEMENT

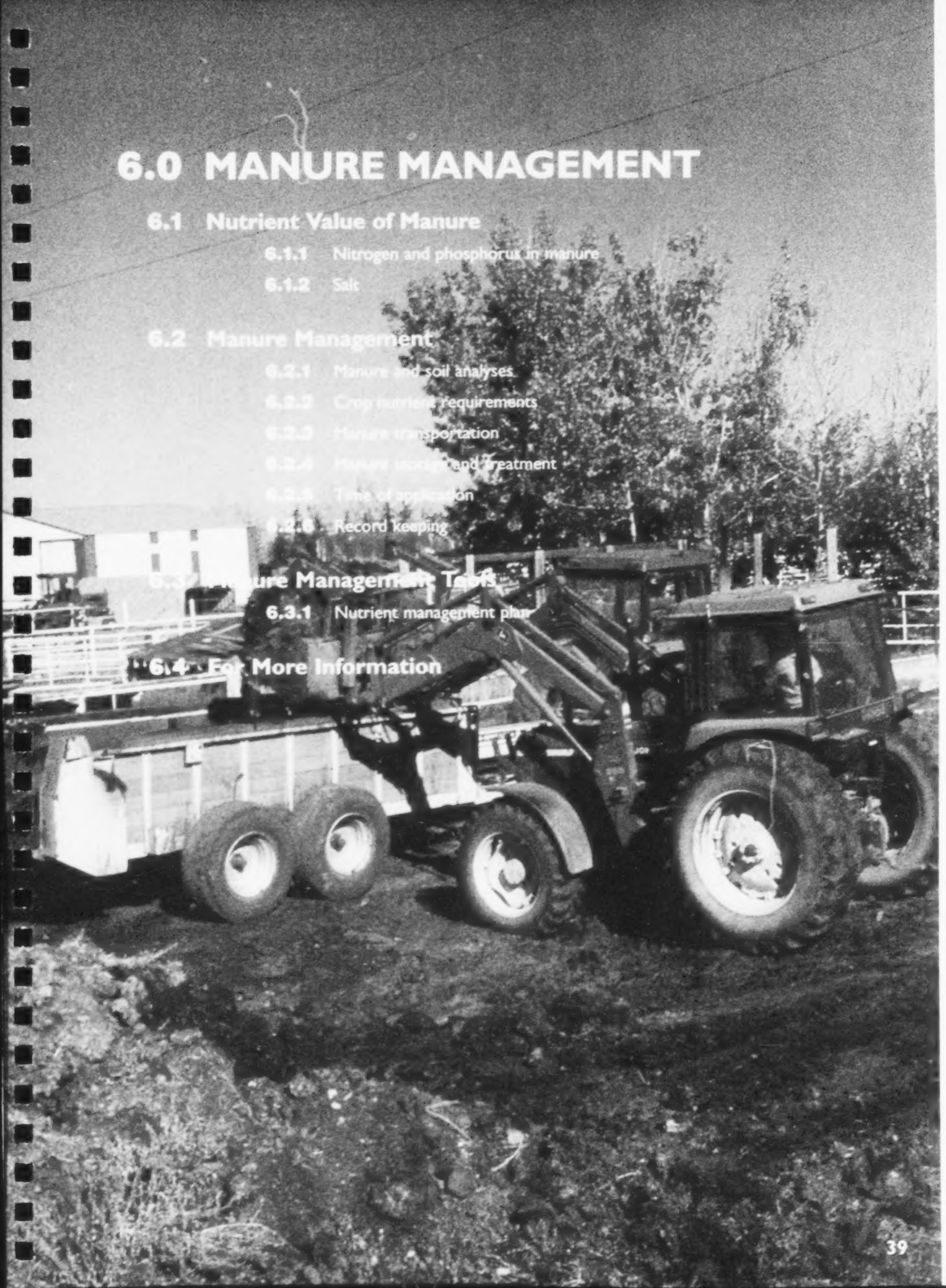
6.1 Nutrient Value of Manure
    6.1.1 Nitrogen and phosphorus in manure
    6.1.2 Salt

6.2 Manure Management
    6.2.1 Manure and soil analyses
    6.2.2 Crop nutrient requirements
    6.2.3 Manure transportation
    6.2.4 Manure storage and treatment
    6.2.5 Time of application
    6.2.6 Record keeping

6.3 Manure Management Tools
    6.3.1 Nutrient management plan

6.4 For More Information





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6.4 For More Information

6.0 MANURE MANAGEMENT

Manure can be a valuable resource if handled properly. It is an excellent source of nutrients and can improve soil tilth, structure and water-holding capacity. Manure has several advantages over commercial fertilizers, including on-farm availability, nutrient composition and ability to enhance the organic matter of soil.

However, if manure application is not properly managed, excess nutrients may be applied to agricultural land. Micro-organisms (including pathogens), weed seeds and salts are also present in manure.

All agricultural operations that handle manure are required to comply with the *Agricultural Operation Practices Act* (AOPA). The Act sets out standards for manure application and site selection of short-term solid manure storage areas. Producers handling more than 500 tonnes of manure are required to keep records. It is important to note that manure includes bedding material.

Risks that may be associated with land application of manure and compost include:

- Excess phosphorus (P) and nitrogen (N) application on land from manure and mineral fertilizers may result in phosphorus and nitrogen runoff to surface water bodies and nitrate leaching to groundwater.
- Excess phosphorus in water bodies may cause excessive growth of aquatic plants. The decomposition of these plants can reduce oxygen to critical levels, which may adversely affect fish survival.
- Organic matter in a water source may cause physical and biological damage, including oxygen depletion.
- Excess nitrates may reduce ground or surface water quality and the water may become toxic to aquatic life, humans and livestock.
- Disease-causing organisms may contaminate water, making it unsuitable for human and livestock consumption.
- Ammonia toxicity can poison fish and other aquatic organisms.
- Nitrogen gases, including ammonia and nitrous oxide (a greenhouse gas), may reduce air quality.
- High salinity in manure may decrease soil quality.

This chapter discusses beneficial management practices (BMPs) related to the land application of manure or compost. Complete nutrient management planning includes the effective use of manure, compost and/or mineral fertilizers as nutrient resources for optimum crop production and minimal impact on the environment.

6.1 Nutrient Value of Manure

Manure should be managed as a resource to maximize its benefits and minimize its risks. To use manure as a resource, producers need to understand its composition. Manure is a mixture of water, organic matter, mineral matter, nutrients and other chemicals. The proportion of each component and the nutrient profile of the manure depend on animal age, manure storage and handling, bedding material and diet fed. The nutrients available in manure are nitrogen, phosphorus, potassium, calcium, magnesium, sodium, sulphur, and micronutrients, such as boron, chlorine, copper, iron, molybdenum, zinc, selenium, chromium, iodine and cobalt.

6.1.1 Nitrogen and phosphorus in manure

Manure provides the same nutrients for crop production as commercial fertilizers, but the challenge with manure is that the forms and ratio of the nutrients are not easy to change. Nitrogen is present in manure as ammonium or as organic compounds. Generally, the environmental risks associated with nitrogen are losses to groundwater through leaching or losses to air through denitrification and volatilization. Phosphorus is present in manure in organic and inorganic forms and generally the risk to the environment is the movement of phosphorus in surface runoff from spring snowmelt and seasonal rainfall.

Facts about nitrogen and phosphorus:

- Only ammonium and nitrate (mineral or inorganic forms of nitrogen) can be used by plants.
- Organic nitrogen must be transformed to ammonium (mineralized) and nitrate (nitrification) forms to be used by plants.
- Phosphorus is generally found in three forms: particulate phosphorus (attached to sediments), dissolved phosphorus (water soluble) and organic phosphorus.

Proper manure management reduces the risk of:

- Nitrate leaching.
- Denitrification.
- Phosphorus in surface runoff.
- Ammonia losses to the air.
- Losses by wind and water erosion.

Beneficial management practices for managing manure and compost

- Do not apply near streams or other water bodies. Manure must not be applied within 10 metres of an open body of water if injection is being used, within 30 metres of an open body of water if the manure is being applied to the surface and incorporated within 48 hours, or within 30 metres of a water well (AOPA).
- Surface application or forages and direct-seeded crops should meet or exceed minimum setback distances in Figure 6.2.
- Surface application of manure on forage, frozen or snow-covered land is not recommended. If it is necessary, refer to Figure 6.2 for setback distances.
- Do not apply manure in low, wet areas.
- Establish grassed waterways in erosion-prone areas to slow water movement from the field.
- Leave some of last year's crop residue on the surface and reduce tillage. This increases water infiltration and reduces nutrient losses through wind-blown sediments and runoff.
- When a high amount of nitrogen is required, split the total amount required into two-thirds manure and one-third mineral fertilizer. Apply mineral fertilizer later in the season or band with seed.

Figure 6.1

Nitrogen and Phosphorus Forms and Availability in Manure

	Available 1st year	**Available 2nd year**	**Available 3rd year**	**Environmental risks**
Nitrogen (N)	**25%** of initial organic N content	**12%** of initial organic N content	**6%** of initial organic N content	• Nitrate in groundwater • Volatilization of ammonia • Denitrification as nitrous oxide
Phosphorus (P)	**50%** of initial total P content	**20%** of initial total P content	**6%** of initial total P content	• P in surface runoff (particulate and dissolved) • P leaching into groundwater

Notes:

- Volatilization is the gaseous loss of a substance (e.g. ammonia) into the atmosphere.
- Denitrification is the transformation of nitrate to gaseous forms (under high moisture or saturated soil conditions), which can be lost to the atmosphere.
- Percentages listed in the figure are only estimates. Availability of nutrients from organic sources, such as manure, depends on biological processes in the soil. These processes are affected by many factors, such as temperature, moisture and soil type.

- Reduce the amount of time between manure application and the highest demand for nitrogen uptake by the crop (e.g. apply in spring while plants are actively growing).
- Do not apply if heavy rain is predicted.
- Apply manure on humid and/or cold, calm days to reduce odour.
- Incorporate fertilizers and manure to avoid losses by runoff in areas adjacent to water bodies or areas that have high runoff potential.
- Test soil phosphorus at least once every three years to avoid over-applying nutrients. Over-application of manure will raise soil phosphorus above recommended agronomic levels (contact a crop adviser or soil laboratory for recommended P levels for each crop).
- Test soils in different landscape locations (e.g. knolls, low spots) to determine if excess levels exist in low areas where runoff collects.
- Apply manure according to soil test recommendations, crop yield goals and manure analyses. If manure is not analysed for nutrient content, published estimates can be used. This will reduce excess nutrients in the soil and minimize buildup.
- When applying manure on forages or direct-seeded crops, minimize the impact on waterbodies and groundwater, and the potential for nuisance odours.
- Surface water that comes in contact with manure must not enter an open body of water or leave the owner's property.

Figure 6.2 **Minimum Setback Distances for Application of Manure on Forage, Direct-Seeded Crops or Frozen or Snow-Covered Land (AOPA)**

Mean Slope	Required Setback Distance from Open Body of Water
Less than 4%	30 m
4% but less than 6%	60 m
6% but less than 12%	90 m
12% or greater	No application allowed

6.1.2 Salt

Manure can contain considerable amounts of salt that may affect soil quality. High levels of sodium can disperse aggregates, degrade soil structure and reduce water infiltration into soil.

Management of soil salinity is crucial for sustainable crop production. Saline soils can reduce crop production and limit cropping options (contact a crop adviser for information on crop salinity tolerance).

To control salt:

- Monitor salt levels in feed rations (contact a livestock nutritionist for recommended levels in feed).
- Monitor electrical conductivity (EC) levels in soil. Electrical conductivity is a measurement of soil salt content and is measured in deciSiemens/metre (dS/m). A change of more than 1 dS/m may indicate a soil quality problem. If the EC is more than 2 dS/m, plant growth and yield may be affected. If the EC is more than 4 dS/m, manure application should not be considered. Check AOPA for EC limitations.
- Monitor the sodium adsorption ratio (SAR) levels in soil. Sodium adsorption ratio is a measurement of sodium in relation to calcium plus magnesium. SAR levels above 8 in soil can reduce soil permeability and increase the likelihood of the soil becoming waterlogged.

6.2 Manure Management

6.2.1 Manure and soil analyses

Manure analysis provides information on nutrient content in manure. The amount of nutrients available for crop growth can be estimated using nutrient analysis information. To estimate crop-available nutrients in manure, consider the chemical makeup of the nutrients in manure, previous manure applications, volatilization, nitrogen fixation and mineralization (breakdown of organic matter into available plant nutrients). When calculating manure application rates, include residual crop-available nutrients from manure applied in recent years.

Accurate manure analysis and application rates are important because problems can result from either inadequate or excessive nutrients in the soil. Manure analysis recommendations are based on the nutrient content in manure, crop to be grown, soil type, soil nutrient levels, climate, soil moisture and other management practices, such as dryland versus irrigation.

Manure analysis

Analyse manure for three to five consecutive years and compare the results to the book values. If there is a large discrepancy, do not use the book values. Instead, develop new average values for the operation.

Although the most reliable source of information is from sampling the operation's manure, book values of manure nutrient content are available and are better than not considering the nutrients in the manure at all.

Manure sampling

Manure testing helps generate a long-term database for planning and economic evaluation, as well as demonstrating due diligence. It is important that manure samples represent the entire volume of manure, not just the surface layer. Appropriate manure application rate is closely related to how manure samples are collected.

Collecting manure samples:

- Collect composite samples that reflect the overall variability of the manure.
- When sampling liquid manure, agitate the manure completely prior to sampling. If the manure is not agitated prior to sampling, take sub-samples from different locations and depths of the storage facility.
- When sampling solid manure containing bedding and other materials, all compounds in the sample should be in the same proportion as they occur in the pile. Solid manure is best sampled directly from the manure truckloads (three to four samples per load).
- Collect about 20 samples from each manure source. Mix the samples together; remove a sub-sample (about 1 kilogram) and place in a sealed container. Keep cool and send to the laboratory as soon as possible.
- Sampling before, but as close to land application as possible, helps to build an accurate database.

Handling manure samples:

- Contact the laboratory prior to sampling to obtain specific information on sample size, shipping instructions and costs.
- Avoid any handling that could alter the physical and chemical composition of manure samples (e.g. leakage, nutrient loss to the air, loss in moisture, room/warm temperature).
- Use sealable freezer bags for solid manure. Seal the bag and prevent leakage by putting the bag inside another freezer bag (double bagging).
- For liquid manure, use plastic or glass containers.
- Immediately send the samples to the lab. Otherwise, freeze the samples until delivery.
- In all situations, **fill the container only half full** and label with the name, date and sample identification. The sooner the sample is sent to the lab, the more reliable the laboratory results will be.

Manure laboratory results:

- Manure tests should at least include percentage dry matter, total nitrogen, ammonium nitrogen and total phosphorus. If there is a possibility of other soil deficiencies, other nutrients can be measured, such as potassium, sulphur and micronutrients. Analysing EC and the SAR in manure are necessary only to determine if changes in feed rations affect manure quality.
- Request manure test results in the same units used for calibrating the manure application equipment (pounds or kilograms). Take special care when converting units.
- Manure nutrient results should be on a wet (or "as is") basis since manure is spread wet.

Soil analysis

Soil analysis is used as an index for nutrient availability in soil. Good nutrient management decisions cannot be made without knowing the nutrients available in the soil and their levels. The higher the nutrients in the soil test, the lower the application rate of fertilizer/ manure. An accurate soil test (proper soil sampling and interpretation of soil test) can be an excellent nutrient management tool.

Misuse or faulty interpretation of a soil test, on the other hand, leads to increased costs, yield losses, and/or environmental contamination. Soil tests can also indicate nutrient or salt surpluses. If test results suggest an excess, base manure application rate on the excess nutrient; then use inorganic fertilizer to supplement other nutrient levels

To prepare a soil sample:

- Collect a representative sample, based on in-field variations in topography (slope), soil type, cropping management and cropping history.
- Collect soil samples from depth intervals of 0 to 15 centimetres (0 to 6 inches), 15 to 30 centimetres (6 to 12 inches) and 30 to 60 centimetres (12 to 24 inches) at 20 to 30 sites per field or field management area. Place samples from each depth in a separate container. Sample to greater depths (below 1 metre) every three to five years to check for nitrate leaching for fields that receive regular manure application or fields with a history of heavy manure application.
- Mix samples taken from same depth intervals and remove about 0.5 kilogram (1 pound) from each depth. If the field is variable, keep the samples from different areas (variations) separate.
- A soil sampling probe is best for taking samples. While an auger can be used, it can be difficult to accurately separate depth intervals. Tools may be borrowed or purchased from fertilizer dealers or soil testing laboratories.
- Ideally, take samples prior to seeding, but if time is a constraint then fall sampling is the best alternative. Because changes in soil nutrients occur more slowly below soil temperatures of 7°C, collect soil samples at or below this temperature, but prior to freeze-up.
- Analyse soil at the very least for plant-available nitrogen and phosphorus. Analyse for other nutrients (sulphur, potassium, micronutrients) if there is a possibility the soil may be deficient. It is also important to monitor soil salinity (EC) and possibly SAR on a regular basis.

Soil test interpretations:

- If nutrient recommendations are included in the laboratory report, there is no need for soil test interpretations.
- If recommendations are not included with soil test results, consult a crop adviser or private consultant for soil test interpretations and recommendations.
- Not all manure has the ideal composition to meet crop requirements. Organic materials do not contain nutrients in the exact proportions that crops require.
- Adjust application rates to meet the requirement for nutrients that will result in the lowest application rate. Inorganic fertilizers can be used to supplement other nutrients to the recommended levels.
- Avoid yearly applications to the same land unless manure and soil tests indicate there is no risk of excess nutrient levels.

6.2.2 Crop nutrient requirements

Nutrient requirements vary from one crop to another. Therefore, for the same conditions, application rates will be different, depending on the crop. Targeted yield for a given crop is an important factor in determining the amounts of nutrients to be added. Crop yield targets are used to determine nutrient requirements and the manure rate. To estimate targeted yield, average the yields of the previous four harvests for a given field and add five to 10 percent as an expected improvement factor.

The overall objective for considering manure and soil analyses, as well as cropping system components, is to determine an accurate manure application rate.

To determine crop nutrient requirements:

- Apply the manure with the highest nutrient content to crops with the highest nutrient requirements (See Figure 6.3).
- Generally legumes do not require added N. Do not apply high N manure to legumes.
- Apply manure with the lowest nutrient content to fields closest to the manure storage site and the highest nutrient content to the furthest fields. This reduces the cost of hauling because a lower amount of manure is needed when nutrient concentration is higher.

Figure 6.3 **Nutrient Uptake and Removal by Various Crops**

Crop		Yield	N	P_2O_5	K_2O
		Tonne* or kg/ha	kg/ha		
Spring Wheat	Removal [1]	2,690	67	27	20
	Uptake [2]	2,690	95	36	82
Winter Wheat	Removal	3,360	55	29	19
	Uptake	3,360	76	35	80
Barley	Removal	4,300	87	38	29
	Uptake	4,300	124	50	120
Oats	Removal	3,810	69	29	21
	Uptake	3,810	120	46	164
Rye	Removal	3,450	66	28	22
	Uptake	3,450	103	52	147
Corn	Removal	6,280	109	49	31
	Uptake	6,280	171	71	145
Canola	Removal	1,960	76	41	20
	Uptake	1,960	126	58	91
Flax	Removal	1,510	57	18	17
	Uptake	1,510	80	22	49
Sunflower	Removal	1,680	61	18	13
	Uptake	1,680	84	29	41
Potatoes	Removal	45*	143	41	242
	Uptake	45*	255	75	334
Peas	Removal	3,360	131	39	40
	Uptake	3,360	171	47	154
Lentils	Removal	1,290	68	21	37
	Uptake	1,290	103	28	86
Alfalfa		11*	103	28	86
Clover		9*	255	75	334
Grass		7*	242	63	226
Barley Silage		10*	115	34	146
Corn Silage		11*	174	59	138

[1] Total nutrient taken up by the crop.
[2] Nutrient removed in harvested portion of the crop.

* Conversion of yields to metric units assumed the following bushel weights (in pounds per bushel): wheat = 60; barley = 48; oats = 34; rye = 56; corn = 56; canola = 50; flax = 56; sunflower = 30, peas = 60; and lentils = 38.

P_2O_5 x 0.4364 = P
K_2O x 0.8301 = K
kg/ha x 0.8924 = lbs./ac.
tonne/ha x 0.4461 = ton/ac.

Source: *Canadian Fertilizer Institute (Modified)*

6.2.3 Manure transportation

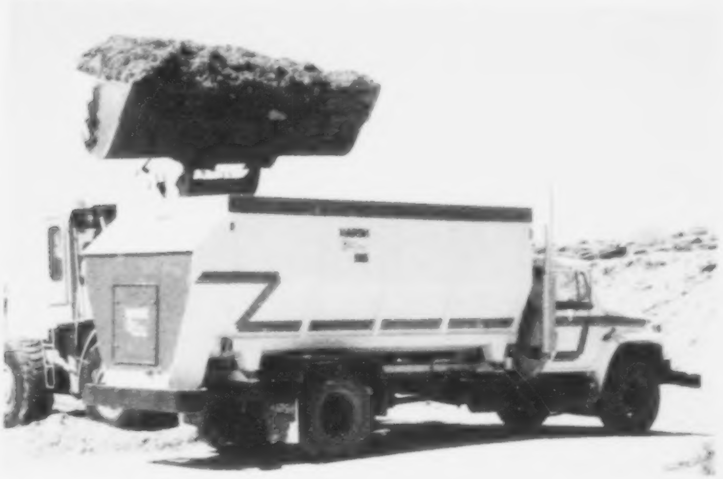
Moving manure from the pen to the field is an important part of a manure management system. It requires not only an economically sound system, but also one that is safe and responsible.

It is important to recognize the nuisance and risks associated with manure transportation. These include dust, spillage and physical impact on roads. Traffic from hauling manure can be very intense for short periods of time. Traffic on gravel roads during dry, windy periods can generate considerable dust. If these conditions exist in "sensitive areas," dust suppression or detouring may be necessary. Beware of manure spills on the road as these may be in violation of the *Transportation Act* and *Alberta Environmental Protection and Enhancement Act*.

Manure is considered a biodegradable product; however, direct spillage from manure trucks must be kept to a minimum. Manure spillage may be a result of seepage, overloading or blowing. Use appropriate management techniques and equipment to prevent manure spillage onto roads and ditches. In the event of excessive spillage, cleanup measures, such as sweeping, are required.

If the spillage of manure appears to have a high risk to the environment, i.e. in a waterway, Alberta Environment must be contacted through their Environmental Response Centre at 1-800-222-6514.

Figure 6.4 **Manure Hauling**



6.2.4 Manure storage and treatment

For specific information on short-term solid manure storage, see Section 4.2.1.

Cattle produce solid manure that is high in nitrogen and phosphorus, which makes it an excellent fertilizer resource if handled properly. To use manure more economically, the volume of water in solid manure must be reduced. Manure can be stockpiled or composted. Place stockpiles in areas that will have minimal impact on water and turn the pile once or twice before moving it to a planned and managed site. A true compost system requires turning a manure pile, based on the moisture and temperature condition of the material in the pile, to produce a well-balanced product.

6.2.5 Time of application

It is best to apply manure before the early stages of crop growth. Spring application is the most desirable for Alberta operations because high nutrient availability matches crop uptake. However, in the spring there are usually fewer opportunities for application because of inclement weather, risk of soil compaction and the time required for other activities. Manure can also be applied in the fall. But, the longer the time between application and the stage at which the crop uses the nutrients, the higher the risk of nutrient losses.

Figure 6.5 **Environmental Risks and BMPs for Manure Application at Different Times of the Year**

Season	Watch For	BMP
Winter	• Runoff that can pollute surface water. • Sensitive areas. • Sloping topography. • Saturated frozen ground with slope or no infiltration.	• Manure should go into storage. • Avoid application on frozen or snow-covered ground. • Avoid spreading on land with a history of floods or heavy runoff.
Spring	• Wet soils that are prone to compaction. • Denitrification that happens in cold, wet soils. • Excessive application that can create a pollution hazard. • Very dry soils with large cracks. • Heavy surface residue that slows the drying process of seedbeds. • Planting too soon after heavy manure application, which can create ammonia toxicity and reduce germination and growth.	• Apply to land before seeding annual crops. • Incorporate manure into soil within 48 hours of application. • Apply to well-drained soils. • Apply to pasture early to avoid trampling re-growth.
Summer	• Loss of nitrogen if there is no rainfall within 72 hours. Rain will help manure soak in but excess rain will increase runoff. • Mature crops that are not growing and don't need nutrients.	• Compost manure to reduce odour and break up clumps.
Fall	• Denitrification in cold, wet soils. • Manure that soaks into wet fields slowly; excess water will run off. • Wet soils that are prone to compaction.	• Apply to annual cropland before ground freezes and incorporate within 48 hours. • Base application rates on soil tests and crop rotation for next year. • Apply to well-drained soils.

6.2.6 Record keeping

Recording and keeping all documents related to nutrient management is important. Documents can provide information on how nutrient management is implemented on the farm, and where and when changes are needed. Records also help generate accurate on-farm data that can be used to formulate site-specific information. Under AOPA, anyone who applies, receives or transfers control of 500 tonnes or more of manure per year must keep records for a minimum of five years.

Records that need to be kept, if more than 500 tonnes, include:

- Manure production
  - Volume produced
  - Source of manure
- Manure transfer
  - Who transferred the manure
  - From where
  - To where
  - Date of transfer
  - Volume of manure transferred
- Manure application
  - Soil tests (at least ever three years)
  - Name of receiver
  - Location spread
  - Amount received
  - Total N application rate
  - Total crop N application rate
  - Total P application rate
  - Application methods used for each field

6.3 Manure Management Tools

6.3.1 Nutrient management plan

Livestock operations should develop and implement comprehensive, site-specific manure and nutrient management plans. Nutrient management is defined as a system that balances nutrients in fertilizers, manure and soil with the requirements of the crop, thus enhancing the economic and environmental sustainability of farming operations. An efficient nutrient management plan is one that is environmentally sound, minimizes nutrient losses during collection, storage and application, and maximizes nutrient use.

The seven critical steps in building a nutrient management plan are:

1. Determine manure amount.
2. Determine manure nutrient value.
3. Determine soil nutrient levels.
4. Determine nutrient requirements based on manure and soil nutrient levels, and crops and expected yields.
5. Determine field limitations.
6. Prioritize fields.
7. Determine manure and inorganic fertilizer needs for each field.

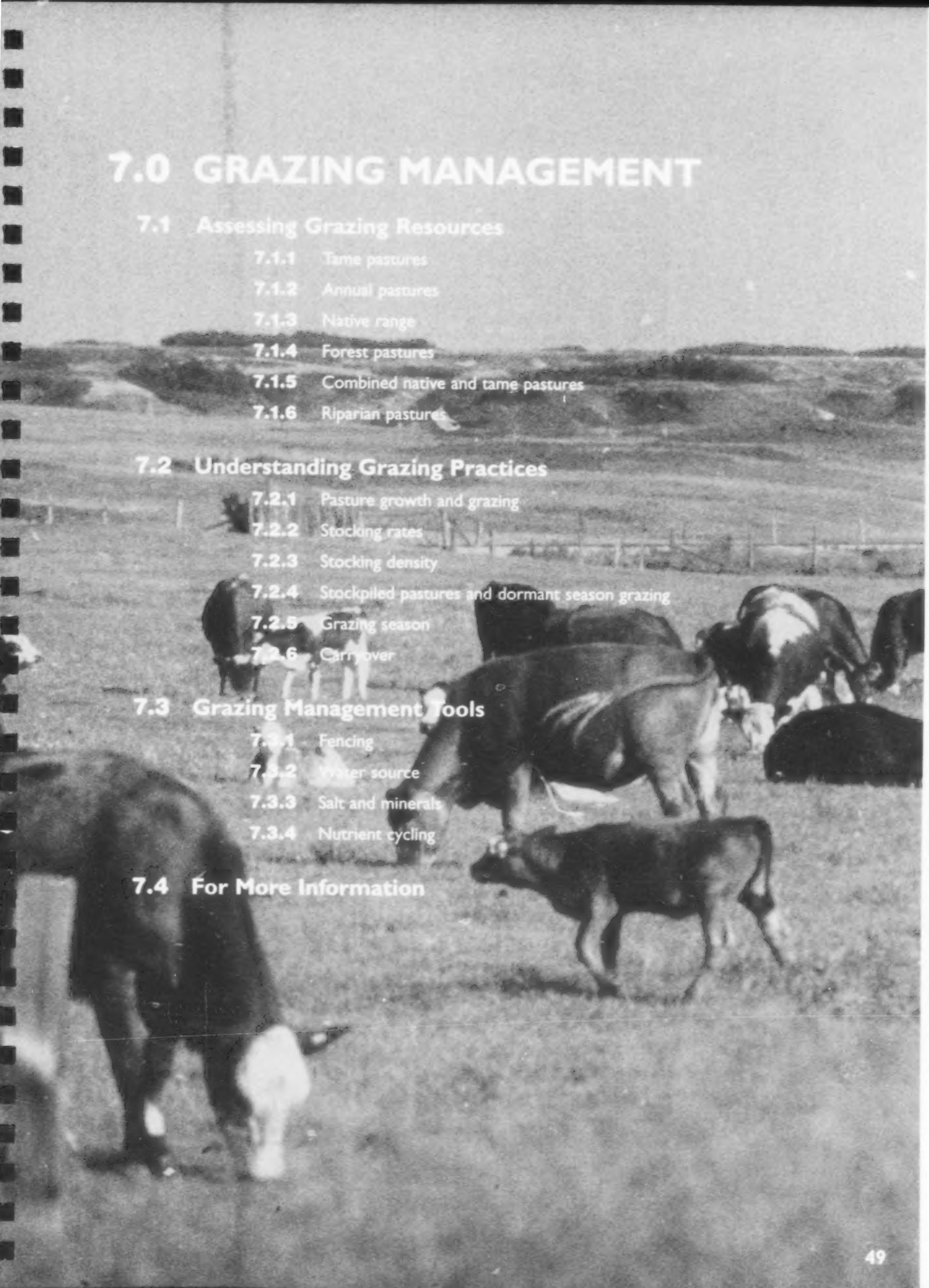
6.4 For More Information

Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Beneficial Management Practices: Environmental Manual for Feedlot Producers in Alberta.*
- *Nutrient Management Planning for Livestock Production.*

Contact your local agricultural service board for information on nutrient management courses.



7.0 GRAZING MANAGEMENT

7.1 Assessing Grazing Resources
  7.1.1 Tame pastures
  7.1.2 Annual pastures
  7.1.3 Native range
  7.1.4 Forest pastures
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  7.2.1 Pasture growth and grazing
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  7.2.3 Stocking density
  7.2.4 Stockpiled pastures and dormant season grazing
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7.3 Grazing Management Tools
  7.3.1 Fencing
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7.4 For More Information

7.0 GRAZING MANAGEMENT

Grazing lands are the backbone of the cow/calf industry and are important to wildlife, biodiversity and water quality. Grazing management is the care and use of range and pasture to obtain the highest sustainable yield of animal products without endangering forage plants, soil, water resources and other important land attributes.

A grazing system is a plan for managing when and where livestock graze. It is a strategy for making productive use of pasture resources so that livestock production goals can be met while maintaining and improving the pasture. To build a successful grazing system, assess the operation's grazing resources, develop a strong understanding of the principles behind good grazing management and learn about the tools available.

Good grazing management should:

- Keep pasture covered with desirable and healthy forage plants.
- Support the increase or maintenance of livestock production capacity and wildlife habitat.
- Improve water-holding capacity of the land base and prevent rapid runoff of rainfall.
- Control soil erosion.
- Balance forage supply with livestock production.

Benefits of good grazing:

- Removes older plant material that is less vigorous.
- Increases light available to lower, younger leaves.
- Improves water conservation.
- Recycles nutrients through manure and urine.

7.1 Assessing Grazing Resources

Well-managed and sustainable pasture lands are dependent on a producer knowing and understanding the operation's grazing resources.

Most beef herds will use more than one pasture type throughout the year. The most suitable grazing system depends on the relative amounts of:

- Native range area.
- Improved (tame) perennial pasture area.
- Cultivated lands available for annual pasture.
- Nutrient requirements of the herd.
- Complementary or competing enterprises on the farm.
- Other feeds available.

In any grazing system, pay extra attention to livestock distribution.

Some grazing areas are unsuitable for the production of annual cultivated crops due to topography, climate, soil type and susceptibility to erosion. Many of these areas are also sensitive to damage from improper use; riparian areas are susceptible to erosion through frequent or severe grazing that removes deep-rooted vegetation. Native pastures, such as open grassland, parkland and forest provide excellent summer and fall grazing, but are generally not ready for grazing early in the growing season.

Each pasture type has unique characteristics and limitations that require specific management practices. By developing a unique management plan and being flexible in its application, producers will be better able to deal with changing weather conditions and the unique features of each site.

7.1.1 Tame pastures

Pastures that have been cultivated and seeded with improved species are referred to as tame pastures. They are more responsive to intensive management and, depending on the species seeded, are useful for year-round grazing.

7.1.2 Annual pastures

Annual pastures consist of cultivated areas that are seeded each year with annual crops for grazing purposes. Using annual pastures allows a rest period for native and tame pastures and lengthens the grazing season. Use annual crops to supplement forage production of perennial pastures or use as emergency pasture. Examples of annual crops include oats, barley, fall rye, spring-seeded winter wheat, winter triticale, annual rye grass and forage kale.

7.1.3 Native range

Manage native range to obtain maximum animal production, as well as to support the long-term sustainability of the natural resource.

Goals of native range management:
- To maintain a diversity of native plant species, especially those that are deep-rooted and productive.
- To maintain vigorous, healthy plants with well-developed root systems.
- To maintain adequate vegetative cover to protect soils from erosion and conserve moisture.

Use the following management principles to maintain and foster healthy, productive native rangeland.
- Balance livestock demands with the available forage supply, but take care to leave adequate residue to protect plants and soil.
- Promote even livestock distribution by using tools such as fencing, salt placement and water development to spread the grazing load over the landscape.
- Avoid grazing rangeland during sensitive periods. Grazing too early in the spring can stress range plants because the new growth depletes plant energy reserves.
- During the growing season, provide rest periods after grazing to allow range plants to recover from the stress of grazing.

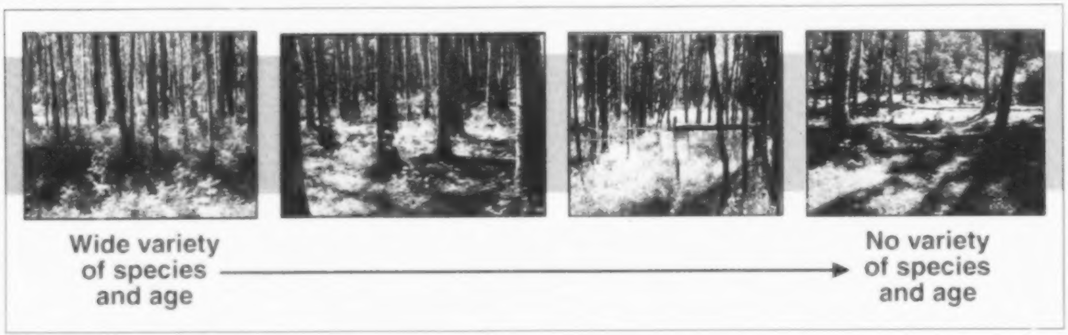
Alberta's native rangelands fall into four major landscape units – Mixed Grass Prairie, Fescue Prairie, Aspen Parkland and Boreal Forest. These landscapes vary with climate, annual precipitation, soil and topography.

7.1.4 Forest pastures

Forest pastures vary in the amount of forage they produce, depending on how they are grazed and how they respond to grazing. In a forest pasture, forage is provided by a variety of plant species, including shrubs, forbs, and grasses. Grassy plants often provide only a small portion of the available forage. The grazing season for forest pastures is relatively short. Plants in forest pastures produce little forage before the middle of May or early June and the nutritional value drops quickly as the plants mature. Native forage plants in forest pastures do not tolerate heavy grazing pressure, and many palatable and productive plants can easily be grazed out.

The grazing schedule during the summer affects the survivability of plants in a forest pasture. Timing determines whether cattle consume more or less shrub material; palatability drops as the summer progresses. Grazing early in the summer reduces shrub growth; grazing late in the summer and into the fall allows the forest undergrowth to develop.

Figure 7.1 **Forested Pastures**


Wide variety of species and age
No variety of species and age

7.1.5 Combined native and tame pastures

To manage a combination of tame pasture and native range, fence the different types into separate fields. Palatability, tolerance of grazing pressure and grazing schedule should be different for native and tame pastures. In many cases, it is more efficient to graze tame pastures early and to delay the use of native pastures until later in the season. The regrowth that occurs on tame pastures while forested pastures are being grazed can be used for late summer or fall grazing.

7.1.6 Riparian pastures

Riparian areas are the lands adjacent to water bodies where the vegetation and soils are strongly influenced by the presence of water.

These wet zones can be some of the most productive ecosystems on the Prairies. Water is collected, filtered, slowed and released in these areas, making them rich in vegetation and soil. Besides being an important part of the water cycle, they also benefit wildlife and agriculture. Although riparian pastures comprise only a small portion of the landscape, they are more important than their size indicates.

The abundant growth of trees, shrubs and grass in these areas provides food and habitat to animals, birds, amphibians and fish.

There is great diversity within riparian areas.

Some common features include:

- An abundance of water on the surface or close to the surface.
- Vegetation that requires abundant water to survive.
- Soils that are often modified by abundant water (as in high water tables), stream processes and lush, diverse vegetation.

Benefits of these green zones include:

- Water filtration, which controls salinity and siltation.
- Water flow control, allowing for groundwater recharge.
- Flood regulation.
- Excellent source of clean water.
- Reliable source of pasture.
- Reduction and dissipation of steam energy.
- Maintenance of biodiversity.

Riparian resources and functions are different than those of the uplands and require different management techniques. A proper riparian grazing management system must take into account the specific needs of these areas.

When grazing a riparian area:

- Plan to graze when moisture levels are low and sod is firm, typically late summer. Timing is key.
- Add more rest to riparian areas to ensure good vegetative recovery.
- Use an alternative off-site watering system.
- Use a wide riparian area as well as its associated buffer zone for greater benefits.

Riparian health

Healthy riparian areas are beneficial to cattle producers. A healthy riparian area is one where all normal ecological processes are able to proceed. Riparian health assessments look at several key health indicators, including vegetative (plants) and physical (soils and hydrology) features.

These indicators include:

- Significant deep-rooted forage production.
- Vigorous, overhanging tree and shrub growth.
- Good plant cover, no exposed or bare soil.
- A narrow, deep stream channel.
- A variety of wildlife.
- Strong, solid banks.
- Clean water.

Riparian health assessments give a generalized understanding of the health of the area. This information can help resolve problems; it provides an awareness of the importance of riparian areas and it identifies what can be done to maintain healthy green zones and repair damaged ones. Health assessments should be repeated at regular intervals to evaluate the changes caused by human interaction and natural occurrences.

For assistance in evaluating the health of a riparian area, or for more information, contact Cows and Fish at www.cowsandfish.org.

Figure 7.2 **Unhealthy Riparian**

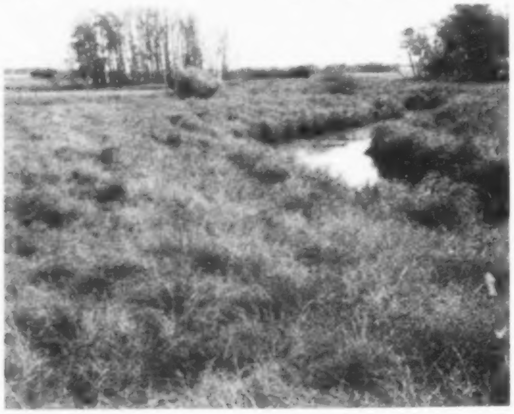
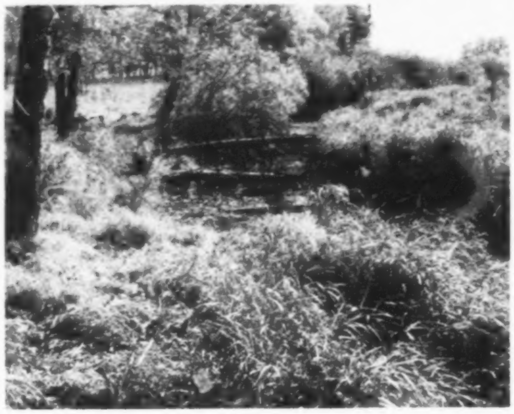


Figure 7.3 **Healthy Riparian**



7.2 Understanding Grazing Practices

7.2.1 Pasture growth and grazing

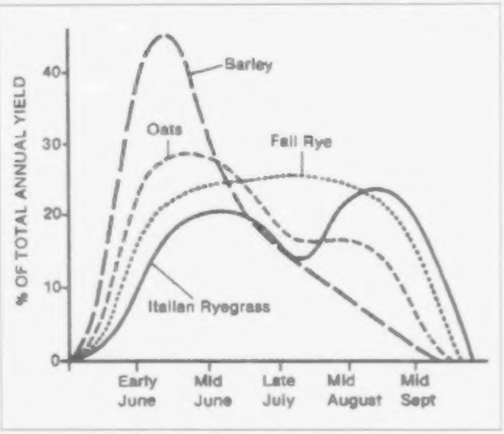
Grazing management is the care and use of range and pasture to obtain the highest sustainable yield of animal products without endangering forage plants, soil, water resources and other important land attributes. Accomplishing these goals requires maintaining an adequate leaf area on desirable plants in order to intercept the sunlight on which photosynthesis depends. Animal grazing must also be controlled so that plant vigour is maintained, and water and nutrient cycles are enhanced. Cows are selective in the type and maturity of the plants they graze. This selectivity may lead to uneven utilization of the pasture. Grazing systems that control where and for how long the cattle graze result in healthier pastures, higher productivity and potentially a longer grazing season.

The growth potential of forage plants on range and pasture is determined by:

- Plant species.
- Previous grazing management.
- Leaf area.
- Day length.
- Temperature.
- Availability of water.
- Availability of soil nutrients.

Leaf area is a characteristic of species; however, plant density and grazing severity also affect leaf area. Day length and temperature mean the majority of pasture growth occurs in the late spring and early summer. Growth slows in the fall as days shorten and temperatures fall.

Figure 7.4 **Grazing Calendar**



Good grazing management that allows rest during active growth periods produces more forage, fewer weeds and healthier animals.

Water is often the most limiting factor to growth. Available moisture peaks in early spring following snowmelt and generally becomes the limiting factor to growth by mid-June in Prairie regions and by mid-July in Parkland regions. In drier areas, late summer or fall moisture can stimulate new growth. If plants are stressed because of drought, they need a longer rest period to recover from grazing. It is important to remember that during drought, plants may go dormant before the end of the growing season.

Litter is old grass residue left from previous production. It conserves moisture by reducing evaporation. It also shades and cools the soil, traps snow, increases water infiltration and reduces raindrop impact.

Maintain as much carryover or litter as possible to help plants recover from drought more quickly.

Proper soil fertility greatly increases pasture productivity when plant density and vigour are good and moisture is not limited. Grasses respond well to nitrogen and sulphur fertilizers. Legumes respond best to applications of phosphorus, potassium and sulphur. Healthy legumes in a mixed pasture can fix enough nitrogen from the atmosphere to improve grass production.

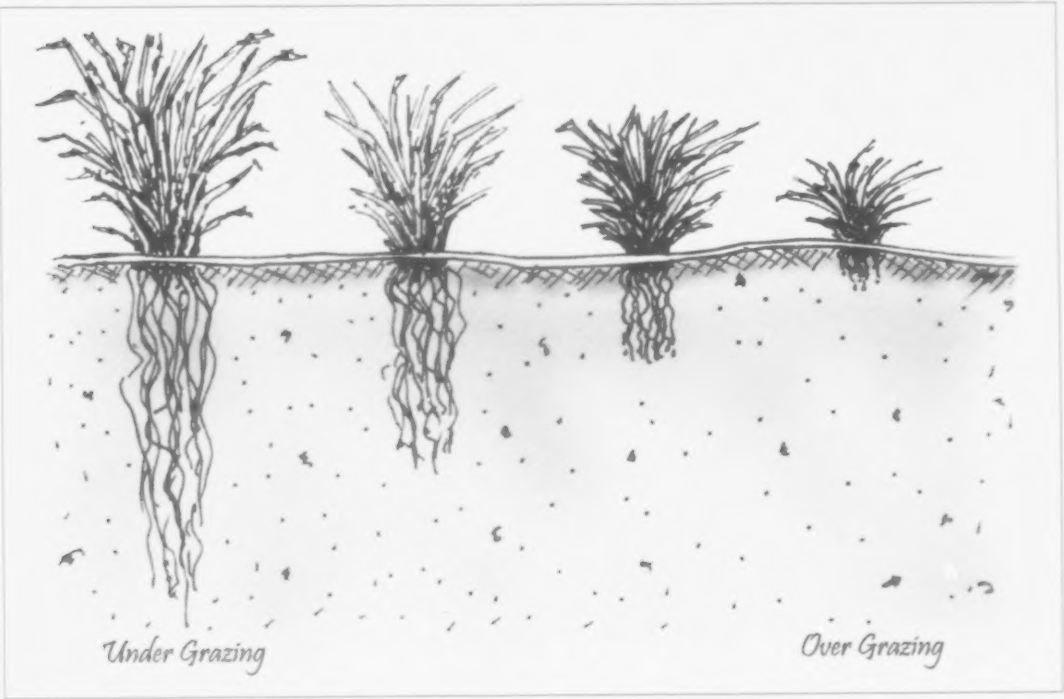
Previous grazing can have a strong impact on the growth potential of forage plants. When plants are stressed, the roots stop growing so there will less forage production. This allows weeds to invade.

Overgrazing results when a plant is grazed before it has fully recovered from a previous grazing or cutting. Undergrazing refers to plants that are not grazed, often because other plants in the pasture are being selectively overgrazed. This is not to be confused with carryover – carryover is planned so that pasture is uniform in quantity and stage of maturity.

Heavy grazing removes a high percentage of the plants' leaves, often to the point where photosynthesis and re-growth are slowed.

Removal and trampling of old and undesirable plant material by severe grazing can improve the pasture, provided that a sufficient rest period is allowed. Severe grazing without the proper rest period is one example of overgrazing, but a light grazing without enough rest is also overgrazing. To maximize productivity and pasture health, the pasture must be stocked with the appropriate number of animals to achieve uniform grazing, provide a recovery period suitable for the climate and severity of the previous grazing, and leave adequate carryover for re-growth and moisture management.

Figure 7.5 **Root Growth versus Grazing Intensity**



7.2.2 Stocking rates

For optimum pasture use, there must be enough animals to use the forage produced; it must achieve the appropriate animal performance and leave the desired amount of carryover or stockpiled material. The stocking rate or carrying capacity is the number of animal units grazed on the pasture for the season.

Carrying capacity is the potential stocking rate of a given parcel of land. If the range is in good to excellent condition, the stocking rate and the carrying capacity may be the same, but if it is a dry year, or if the range is in fair to poor condition, the stocking rate must be reduced to allow for recovery.

Carrying capacity and stocking rate are measured by animal unit month (AUM), which is the amount of pasture needed to support a 1,000 lb. cow (with or without a calf) for one month. Adjustments for different classes and sizes of animals are necessary. To adjust for changes in animal size on an animal equivalent basis, add 0.1 AU above the standard AU for every 100 lb. increase in live weight (i.e. 1,250 lb. cow would constitute 1.25 AU).

Understocking is poor economics. Similarly, overstocking reduces the pasture productivity by reducing the population of palatable plants and increasing weedy and unpalatable species.

Poorly managed pasture land means rainfall and snowmelt will run off because:

- There is not enough vegetative cover to slow water flow.
- There is less organic matter in the soil to absorb water.
- Compaction from trampling further reduces water infiltration.
- The increased runoff can cause soil erosion and reduce moisture needed for re-growth.

Figure 7.6 **Animal Unit Month Equivalents**

Yearlings	0.67 to 0.75 AU
Mature bulls	1.5 AU
Weaned calves	0.5 AU

7.2.3 Stocking density

Stocking density refers to the number of animal units grazing one acre for one day. It is measured as the combined weight of the grazing herd per unit of grazing area for one day. Low stocking density can result in uneven use of the pasture; high stocking density can cause damage to sensitive grazing areas, but may be used as a tool to improve pasture productivity.

7.2.3 Stockpiled pastures and dormant season grazing

To bank or stockpile pasture for use in the dormant season, plan a recovery period that is appropriate for the pasture type and growing conditions. In moist areas, cutting or grazing in early July followed by a pasture re-growth period for the balance of the growing season may provide the best balance between quality and quantity. In drier areas, an entire season's growth might be appropriate. This usually results in an adequate quantity of high quality pasture for use in the fall or the following spring. Proper stockpiling ensures a long rest period that improves pasture vigour.

The length of the feeding season is determined by how heavily the pastures are stocked relative to their growth, and by the grazing system used. If pastures are stocked below their potential for growth within the growing season, surplus forage is available for use in the dormant season. Extending the grazing season in this way shortens the winter feeding period. It may be necessary to provide supplemental feed when using dormant season pasture.

Dormant pasture may not contain an adequate quantity or balance of nutrients for the animals; adjusting these levels can improve pasture utilization and animal performance. To obtain a high level of utilization while grazing dormant pasture, only restrict access to that portion of the field that is to be grazed immediately. Allowing access to the entire grazing area at once could result in feed losses due to the trampling of the forages or due to the restricted availability of the feed because of snow crusting.

7.2.5 Grazing season

To maintain pasture and range conditions, delay grazing until the grasses have produced green leaves and are manufacturing and storing food, unless there is a surplus stockpile of previous years' growth. Another reason to delay grazing in the spring is that different grass species start growing at different times, and this starting time can vary by as much as six weeks. Also, the longer grazing is delayed in the spring, the greater the forage yield. However, palatability and animal performance may decline as the forage matures.

In some cases, it may be impractical to delay grazing until late spring, especially if no other livestock feed is available. In this case, adopt a grazing system or rotation that allows different fields to be used for spring grazing in consecutive seasons. Other common solutions are to seed fields to early-growing species of perennials or annual cereals before other pastures are ready, or to graze pasture that was stockpiled in the previous year.

7.2.6 Carryover

Carryover is the amount of forage left when grazing ends. It protects the soil surface from the drying effects of direct sunlight and wind, and leaves enough leaf area for plant regrowth.

On native range, recommended carryover is 45 percent of the current growth with 20 percent of the seed stalks remaining. However, a carryover of 45 percent every year is impractical because production varies from year-to-year. This variation may range from 35 to 250 percent of average forage production. Forty-five percent carryover is an average value that the proper stocking rate will yield over a period of years.

The need for a consistent amount of carryover is not as critical on tame pastures as it is with native range but it does affect re-growth and moisture retention. Utilization of 70 to 75 percent is often considered proper. This is usually estimated by assessing average stubble height when the cattle are moved to a new pasture. Although proper pasture use according to height varies with species sown and the length of the rest period, a rule of thumb is to remove the cattle when the average stubble height in the pasture reaches seven to 10 centimetres (three to four inches). Continual severe grazing causes depletion of plant food reserves, which reduces stand vigour.

7.3 Grazing Management Tools

When grazing animals are used to harvest a forage crop, they must be managed to graze as uniformly as possible. If left unmanaged, livestock will continue to graze small areas and keep them closely grazed while leaving other areas untouched. Some of the factors that affect livestock distribution are: distance from water, topography, vegetation type and livestock behaviour.

The benefits of proper stock distribution are:

- Nutrient cycling.
- Balanced use and more even grazing of the land base.
- Improved range health.
- Additional AUMs from ungrazed or lightly grazed areas.
- Improved wildlife habitat.
- Recovery of primary range over time, leading to increased AUMs.

Tools to achieve more uniform grazing include:

- A planned grazing system.
- Fencing.
- Water supply locations.
- Salt and mineral locations.
- Nutrient cycling.
- Cattle oilers or rubbing post locations.
- Shelter locations.
- Herding cattle to unused portions of the range or pasture.

Figure 7.7 **Comparison of Grazing Systems**

Type	Description	Advantages	Disadvantages	Management options
Continuous grazing	One pasture is used throughout the entire season.	• Convenient. • Limits fencing. • Limits labour. • Limits the need to develop water supplies.	• Overgrazing and undergrazing. • Lower forage quality and yields. • Uneven pasture use. • Lower stocking rates. • Weeds. • Can be detrimental to the health of the riparian area.	• Adjust stock numbers to match available forage.
Deferred rotation grazing	Grazing is delayed until a critical growth stage has passed. The deferred period is altered between pastures. More than one field is used.	• Limits damage from early grazing. • Provides an effective rest period for forage. • Reduces selective grazing.	• Requires more fencing. • Requires more development of water supplies.	• Vary the length of the rest period. • Vary the stocking density. • Vary the season that each particular field is used.
Management intensive grazing	Grazing areas are divided into smaller units or paddocks and grazed in sequence.	• Maximizes rest period. • Increases stocking density. • Improves nutrient cycling. • Reduces need to mechanically harvest forages.	• High investment in fencing, water. • Labour intensive.	• Vary stocking density. • Vary severity of grazing. • Vary length of rest period.

7.3.1 Fencing

Fencing can improve grazing distribution by:

- Restricting cattle to the grazing land.
- Forcing livestock into areas not usually frequented.
- Restricting access to rest areas.

Fencing can be permanent, temporary or portable, barbed or electric.

7.3.2 Water source

The objective in developing water supplies is to provide a more even distribution of animals over the range, and thus use areas that would otherwise be wasted because of lack of water. Cattle should not have to travel to water more than three kilometres in flat country and no more than 0.8 kilometres in rough country. Cleaning and preserving springs, seeps and ponds can improve natural water supplies. Development can include drilling wells, constructing reservoirs and installing pipelines. Economics and location usually dictate the type of water development. More information on watering systems can be found in Section 5.3.

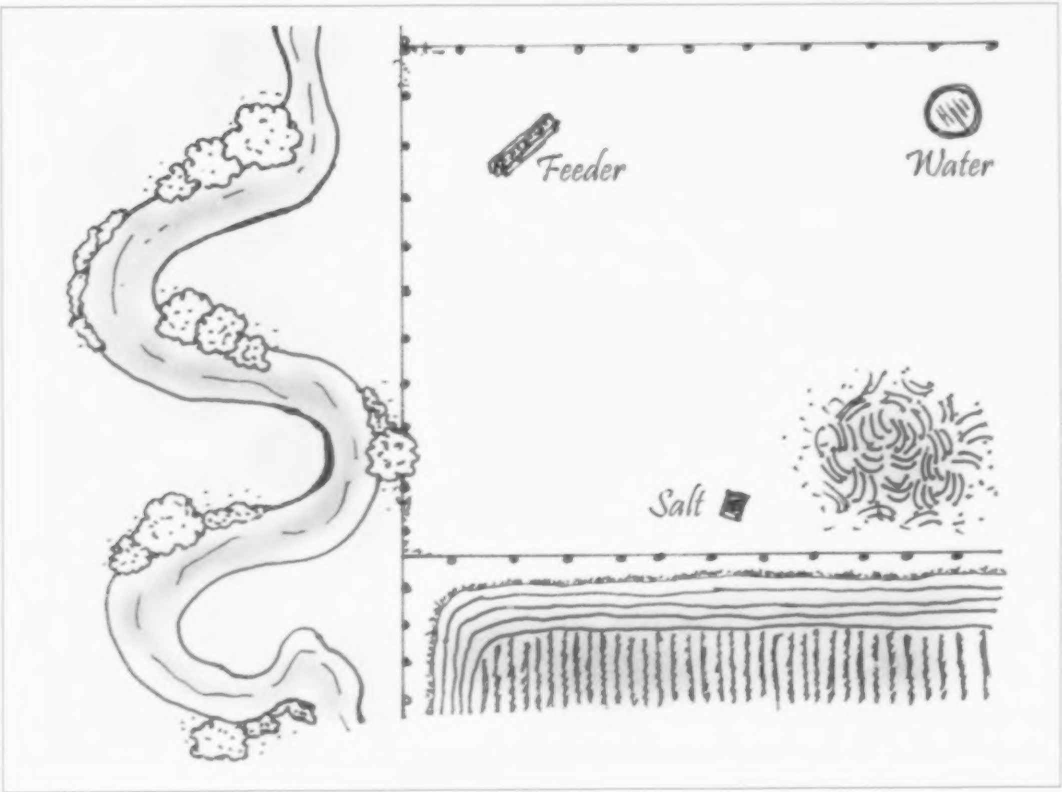
7.3.3 Salt and minerals

Animals usually seek salt. Producers can use this to their advantage to improve grazing by distributing salt throughout the farm.

Options for management of salt and minerals include:

- Periodically move salt minerals and other supplements to new locations.
- Locate salt in underused but accessible areas.
- Avoid feeding in areas prone to erosion.
- Locate salt away from watering sites as this leads to overgrazing and vegetation damage.

Figure 7.8 **Salt and Mineral Locations to Increase Manure Distribution**



7.3.4 Nutrient cycling

Adequate nutrients are required for maximum pasture growth. A soil test of the pasture will indicate the nutrients that may be lacking. When applying commercial chemical fertilizers to pastures, take into account the difference in nutrient requirements between grasses and legumes and the effect that fertilizer could have on species composition of the pasture. For information on manure application, see Section 6.

In all cases, use soil testing as a guide to nutrient management practices. If any one nutrient is lacking, application that includes other nutrients will not provide the needed nutrient response, and could lead to a buildup of excess nutrients in the soil.

Applying fertilizer on native range is not usually recommended because most range areas contain a mixture of grasses, broad-leafed plants and shrubs and the added fertility may favour the growth of undesirable plants. Rangeland research has shown that adequate moisture increases yields but usually not enough to make fertilizer cost-effective.

7.4 For More Information

Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Establishing Hay and Pasture Crops* Agdex FS120/22-2.
- *Grazing Tame Pastures Effectively (Revised June 1998)* Agdex 130/53-1.
- *Understanding the Animal Unit Month* Agdex FS420/16-1.
- *Winter Cereals for Pasture* Agdex 133/20-1.
- *Guide to Range Conditions and Stocking Rates for Alberta Grasslands.*
- *Alberta Forage Manual* Agdex 120/20-4.
- *Fencing with Electricity.*

Cows and Fish
(403) 381-5538
www.cowsandfish.org

- *Caring for the Green Zone: Riparian Areas and Grazing Management, 2nd edition.*

Public Lands
www3.gov.ab.ca/srd/land

- *Grazing Systems for Public Grazing Lands.*

8.0 PEST AND PREDATOR MANAGEMENT

8.1 Burrowing Rodents
  8.1.1 Controlling burrowing rodents
8.2 Wild Ungulates
  8.2.1 Controlling deer and elk
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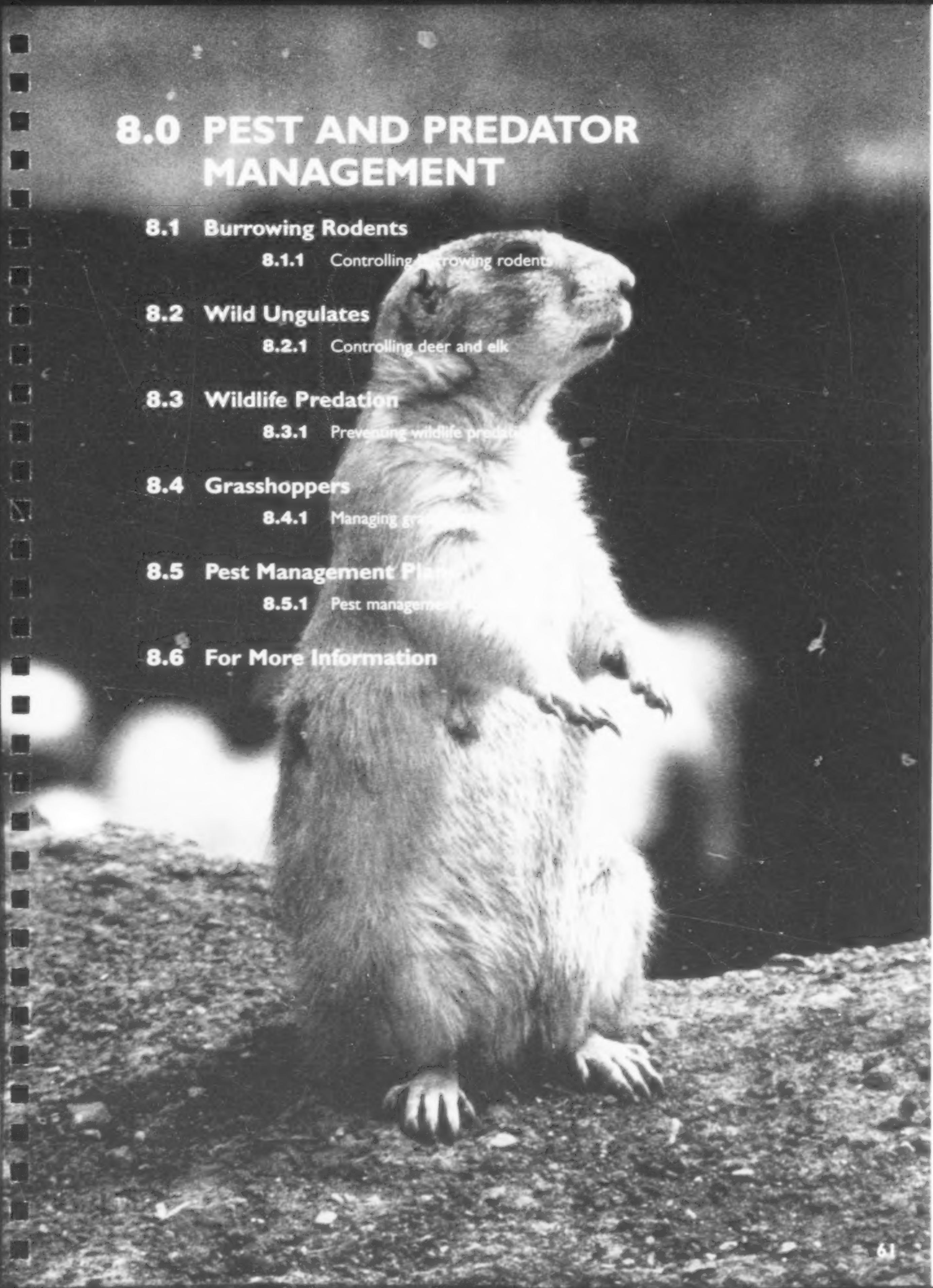


8.0 PEST AND PREDATOR MANAGEMENT

Pests and predators can be a great concern to cow/calf operators. The sharing of natural resources among wildlife, agriculture and other human activities can increase pest and predator damage to an operation.

8.1 Burrowing Rodents

Damage caused by burrowing rodents is usually more detrimental to crops, soil stability and the land than damage caused by birds or ungulates.

The three main rodents that cow/calf producers encounter are:

- Richardson's ground squirrels - also called gophers or prairie gophers.
- Pocket gophers - also called moles.
- Voles - also called field mice.

Ground squirrels are a major food source for badgers, which also damage fields as they dig for the squirrels. Although badger populations are not widespread, damage can be considerable.

Burrowing rodents are permanent residents of land. Damage can vary greatly depending on the size and type of crop and rodent population densities.

The greatest concerns are that burrowing:

- Creates holes that could injure livestock and damage machinery.
- Creates rough land surface resulting in equipment damage.
- Increases weed growth.
- Reduces crop yields.

Burrowing rodents need subsurface tunnels and above-ground corridors for food, nesting, escape, and to multiply. They cannot tolerate mechanized disturbance, particularly deep cultivation or continuous surface activity. Therefore, rodent damage will be greater in fields with perennial and direct-seeded crops, and in chemical fallow systems. When such management systems are coupled with poor weed control, rodent populations can be very high. In particular, Richardson's ground squirrels thrive in weedy, fallow fields and thin, short forage stands. But, some rodents may actually benefit crop production in direct-seeded fields. For example, researchers at the University of Guelph have found that mice and small insects eat most of the weed seeds in zero tillage fields because the seeds are exposed on the soil surface.

8.1.1 Controlling burrowing rodents

Historically, farmers controlled damage from burrowing rodents by destroying them with poisons, traps, fumigants and other "on-farm" inventions. Control methods and strategies are the same in direct-seeded, conventional tillage or perennial forage stands. Ground squirrels can rapidly invade an area, which makes it crucial to apply control measures as soon as the squirrels are seen in a field. Although pocket gophers and mice invade areas more slowly, control measures applied early keep population levels down.

There are different approaches to controlling rodents and the most effective method is to combine these different approaches.

Using poisons on targeted species

- Use poisons such as strychnine alkaloid and zinc phosphide to control pocket gophers and ground squirrels.
- Anticoagulant poisons, such as chlorophacinone and diphacinone, are now registered for pocket gophers and ground squirrels, although control of pocket gophers with poison ranges from poor to fair. Most of these food poison baits are available in ready-to-use formulations. Follow the label instructions for use.
- Place pocket gopher poison directly into the burrow system using a specially designed probe or an artificial burrow builder.
- Some research indicates that fall baiting is more effective than spring baiting.

Using traps on targeted species

- Trapping, using specially designed hand-set traps, is the only long-term solution for pocket gopher control. The traps work well because pocket gophers often plug the openings in their burrows. When a trap is set in an open burrow, the pocket gopher becomes trapped when it attempts to plug the opening.
- Trapping is most effective when gopher numbers are low and the infested area is small. Because pocket gophers do not travel much in a given year and do not live in cultivated land, trapping along the perimeter of new perennial stands prevents their migration into the field. By trapping all perimeter areas, whole fields can be controlled.

Hunting pests within the regulations

- Although very effective in the short-term, hunting is only effective as a long-term solution if it is extensive and thorough. While some animals may be frightened away, whether they return to the area or *not is determined by the species' ability* to travel.
- When hunting pests that hibernate, do not miss the time of year when they are most active. These periods of activity can be quite short.
- During hunting, Richardson's ground squirrels immediately retreat to their burrows. Hunting is relatively ineffective long-term unless the population is significantly reduced.

8.2 Wild Ungulates

Wild ungulates, such as deer, moose and elk, can cause serious crop damage when feed for early winter grazing, swath grazing or spring carryover grazing is preserved in swaths or bales. Deer and elk are attracted to the quality of the feed in the field relative to alternative feed sources within their habitat. Pay special attention to riparian areas where abundant forage growth may attract greater numbers of deer and moose. Since riparian areas have relatively moist soils, high numbers of wild ungulates may cause significant hoof damage.

8.2.1 Controlling deer and elk

The following management practices can deter deer and elk.

- Wrap round bales and stack at least two tiers high. Keep sides as straight as possible to prevent deer and elk from climbing the stacks.
- Stack bales near buildings to serve as barriers.
- Use machinery to protect stack yards.
- Clean up spilled grain, loose hay and other feed.
- Do not allow wildlife to linger because they attract other wildlife.
- Keep wildlife away from farmyards. Scarecrows wearing human-scented clothing and radios may be enough to keep wildlife away if the animals have not become used to humans or are completely dependent on food available in the farmyards.
- Contact the local Alberta Fish and Wildlife office for information on stack protection, scaring devices, repellents, fencing and other prevention programs.

8.3 Wildlife Predation

Conflicts between wild predators and livestock have a long and colourful history in Alberta. Livestock losses to predation occur wherever livestock are raised within the natural ranges of predators. The predominant species involved in predation are coyotes, wolves and bears. The coyote is responsible for the majority of livestock losses in Alberta. Coyotes have expanded their historic range tremendously and are now established in all regions of the province. Wolf and bear predation is generally restricted to the forested areas of Alberta.

Alberta Agriculture, Food and Rural Development (AAFRD) and Alberta Sustainable Resource Development (ASRD) share responsibility for the management of wildlife predation. AAFRD manages livestock predation by coyotes under the authority of the *Agricultural Pests Act* of Alberta. ASRD, Fish and Wildlife Division, manages predation by wolves and bears under the authority of the *Wildlife Act* of Alberta.

8.3.1 Preventing wildlife predation

Coyotes, wolves and bears are opportunistic predators and may attack livestock in pastures, corrals or confined areas. Wildlife predation can occur despite the best efforts of livestock producers. It is paramount that management practices deter predators and discourage their activity around the farm.

Prevention is the best management practice for producers. Once predation has occurred, it usually requires a more concerted effort involving increased time and surveillance to stop the problem. There are several farm management strategies that can assist cow/calf producers in keeping losses to a minimum.

Carrion disposal
Dispose of all dead livestock, stillborn calves and afterbirth by liming and deep burial, or burning. Rendering plants will pick up dead cattle, although a fee is now charged for this service. Some municipalities allow carcass disposal at landfill sites. Avoid carcass or bone piles on the farm, unless in a fenced area, as they attract predators.

Surveillance
Aim to have all calving done as close to the farmyard as is reasonably possible to allow for close surveillance.

Check pregnant cows on a regular basis once calving begins. This is especially prudent for first-calf heifers and any cows experiencing difficulties. Pen these animals near the yard as there is a direct correlation between the amount of time a producer spends with the herd and the potential for livestock losses.

Shooting
Carry a rifle when checking herds, especially if there are predator problems. Ensure the rifle is sighted accurately and be confident using a firearm.

Herding and guardian dogs
A well-trained guard dog can be valuable on the farm. They can detect predators and alert the producer when predators enter the farmyard, and in some cases, can chase the predator away.

Electric fencing
Electric fencing of small pastures and corrals may help prevent predators from accessing young or vulnerable stock.

Lethal control
For coyote predation, contact a local agricultural fieldman for further advice on preventing losses and the possibility of using restricted poisons for coyote control. Restricted poisons are to be used only when all other avenues to stop predation have failed. Strict rules and legislation governs the use of these chemicals.

For wolf or bear predation, contact the local Fish and Wildlife office. Fish and Wildlife officers use culvert traps, foot snares or restricted poisons to control these animals.

Summary
There is no solution for preventing wildlife predation in all situations. However, adopting common sense management practices and appropriate producer vigilance will prevent livestock losses or at least keep them to a minimum.

8.4 Grasshoppers

Grasshoppers can be a major pest to cultivated and uncultivated crops. Semi-arid areas receiving less than 750 mm of precipitation per year are particularly susceptible. Traditionally, drier areas such as southern Alberta are more prone to recurring problems, but serious grasshopper infestations can occur in areas throughout the province.

Although grasshopper damage mostly affects cereal grains, other crops can be seriously affected. Even in a more diversified agricultural landscape, where cereal crops are often rotated with other crops such as canola, lentils and peas, grasshoppers continue to cause significant economic loss in Alberta.

Grasshoppers can consume 30 to 100 mg of plant material (dry weight) each day.

Forage losses are seldom estimated, but even a moderate infestation of 10 grasshoppers/square metre can consume up to 60 percent of the available forage, depending on the condition of the forage stand. The insects can also consume all of the forage crops, but they usually work the outer edges of fields.

The type and extent of crop damage will depend on the type of crop, crop vigour, the number of grasshoppers present, and whether or not adequate cultural and chemical controls are used.

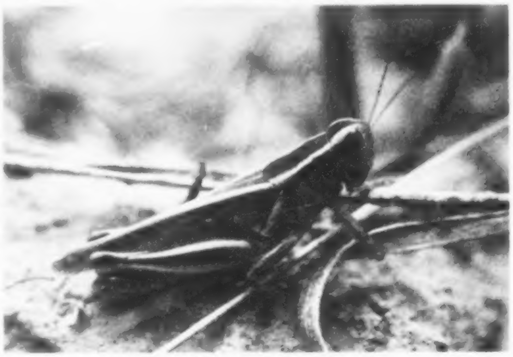
8.4.1 Managing grasshoppers

Cultural control

Grazing management. Grazing management practices that continually remove most of the vegetative canopy and drought conditions that reduce herbage biomass production and plant density favour pest grasshopper species. These conditions allow population numbers to increase to problem levels. Increased solar radiation that reaches the soil surface and increased airflow over the ground result when the canopy is removed by overgrazing and/or drought. Removal of the canopy also decreases relative humidity and increases soil and air temperature. All of these factors favour pest grasshopper species. Higher temperatures hasten egg development, nymphal growth and maturation, as well as adult female egg production. Sunlight and low humidity also decrease the number of important grasshopper pathogens. Canopy removal can also affect basking sites, which allow for early morning warming, perching sites that provide an escape from mid-day high temperatures and preferred egg laying sites on bare patches of soil.

Cultural practices that can negatively affect grasshopper populations are those which increase live plant basal cover, decrease open areas in vegetative canopy cover and increase plant biomass. All of these practices will lower temperatures, increase relative humidity and reduce the amount of solar radiation in the grasshopper microhabitat. These changes have an adverse effect on egg development, nymphal growth and survival, and egg laying. They also encourage higher numbers of beneficial pathogens, which inhibit grasshopper survival, keeping grasshopper populations at lower levels.

Figure 8.1 **Grasshopper**



For example, to inhibit grasshopper populations, mow hay fields before the flowering stage. This stimulates tiller production, increasing basal cover and reducing areas of bare soil. This also produces higher quality hay with increased protein content. Light grazing in the spring is another way to stimulate tillering and achieve the same results.

Rotational grazing is another practice that encourages increased plant basal cover, thereby reducing bare patches of open ground. The increased amount of time between grazings allows plants more time for regrowth and decreases the amount of time the field is without a canopy. Grazing research in Montana and Idaho has shown that there were between 69 percent and 79 percent fewer grasshopper nymphs and between 71 percent and 96 percent fewer adult grasshoppers on twice-over rotation pastures than on season-long grazed pastures.

Chemical control

Insecticides. A number of insecticides are registered for grasshopper control in pastures and hayfields. Insecticides can be applied as sprays or baits, and both can be equally effective if used as directed. Insecticides are most effective when applied while the grasshoppers are still in the early instar stages. Food consumption by grasshoppers increases rapidly after the third instar. The most serious economic damage occurs when the insects are in the third to fifth nymphal stages; implement control measures prior to these stages to prevent economic damage to the crop. Also, as the hoppers approach adulthood, chemical control becomes increasingly difficult and higher rates are necessary. Read labels thoroughly before using any insecticide and observe safety and grazing restrictions. For a complete and up-to-date listing of registered insecticides and rates, consult Alberta Agriculture, Food and Rural Development's "Blue Book" publication, *Crop Protection* Agdex 606-1, which is updated annually.

Reduced agent area treatment (RAAT). This grasshopper control strategy was developed by researchers at the University of Wyoming. It is designed to reduce the amount of insecticide used and the area treated. Insecticide is applied at reduced rates in 30 metre passes alternating with 30 metre untreated passes. Higher rates and greater coverage may be necessary if infestations of later instars or adults occur. This innovative strategy is successful because grasshoppers move from untreated to treated areas. Natural biocontrol agents are preserved in the untreated areas. In a study done in southeastern Wyoming, a RAAT treatment was essentially indistinguishable from a standard blanket treatment; both treatments resulted in 80 to 90 percent grasshopper mortality.

Roadside vegetation management and barriers. Infestations of grasshoppers often begin at the field margins where grasshoppers move in from roadside ditches, treelines or fencelines. Controlling grasshoppers in these areas is an effective method to prevent infestation of a field. Most insecticidal sprays and baits are registered for this use. Use of insecticidal "barriers" around crops is more common in high value crops such as alfalfa. Close monitoring is required and multiple sprays may be necessary to achieve good results.

Biological control

There are three general biological control strategies: classic biological control, augmentative biological control and conservation of natural enemies. Biological control should not replace pesticides and other methods of control. It is meant to be combined or integrated with preventive, physical and chemical controls in an overall strategy or system of control for one or more pests. For example, timely tillage removes the green growth on summerfallow which starves newly hatched grasshoppers. This strategy can be used in combination with the disease-causing agent Nosema and the pesticide Furadan along the edges of the field. This combination of approaches will minimize grasshopper damage.

8.5 Pest Management Plans

The most effective method of pest and predator control is to remove their habitat and food source. For example, reducing broad-leafed weeds using integrated pest management removes a food source for gophers. Although this is effective for the target species (gophers), this strategy affects other non-target species as well; hence, the overall effect on the diversity of the general landscape becomes larger and more costly to the environment. Consideration must be given to the long-term health of the ecosystem when implementing a pest control program. Short-term strategies, such as limiting dandelions, thistles and clovers, may be reasonable for pocket gopher control because pocket gophers require broad-leafed plants for their energy needs. However, radical strategies, such as brush removal from riparian edges for beaver control, have more serious side effects.

Attracting natural predators to an area can reduce pest populations. For example, build nesting platforms to attract hawks and other birds of prey. Contact a local Alberta Fish and Wildlife Office for more information on habitat management for attracting natural predators.

- The most effective management of pests and predators integrates mechanical, biological and chemical controls.
- Understanding the life cycle and habits of the pest/predator is key.

8.5.1 Pest management considerations

Consider the following points when developing and implementing a pest management plan:

- Plan one to three years ahead, before land is converted into forage or cereal production in order to prevent immigration of field rodents. Create crop barriers using shrubs, perennial corridors or annual cropping/fallowing areas to discourage rodent invasion. Remove broad-leafed foliage from the periphery or within the planned crop area to significantly reduce the area's desirability to rodents.
- Use specific perennials that have a repelling effect on field rodent species; for example, castor bean plants repel rodents with reasonably good results.
- Treat the periphery of areas planned for cropping to remove initial invaders. Use traps to prevent/reduce invasion by pocket gophers, ground squirrels and possibly voles. Peripheral trapping eliminates the need to trap an entire cropping area later on.

8.6 For More Information

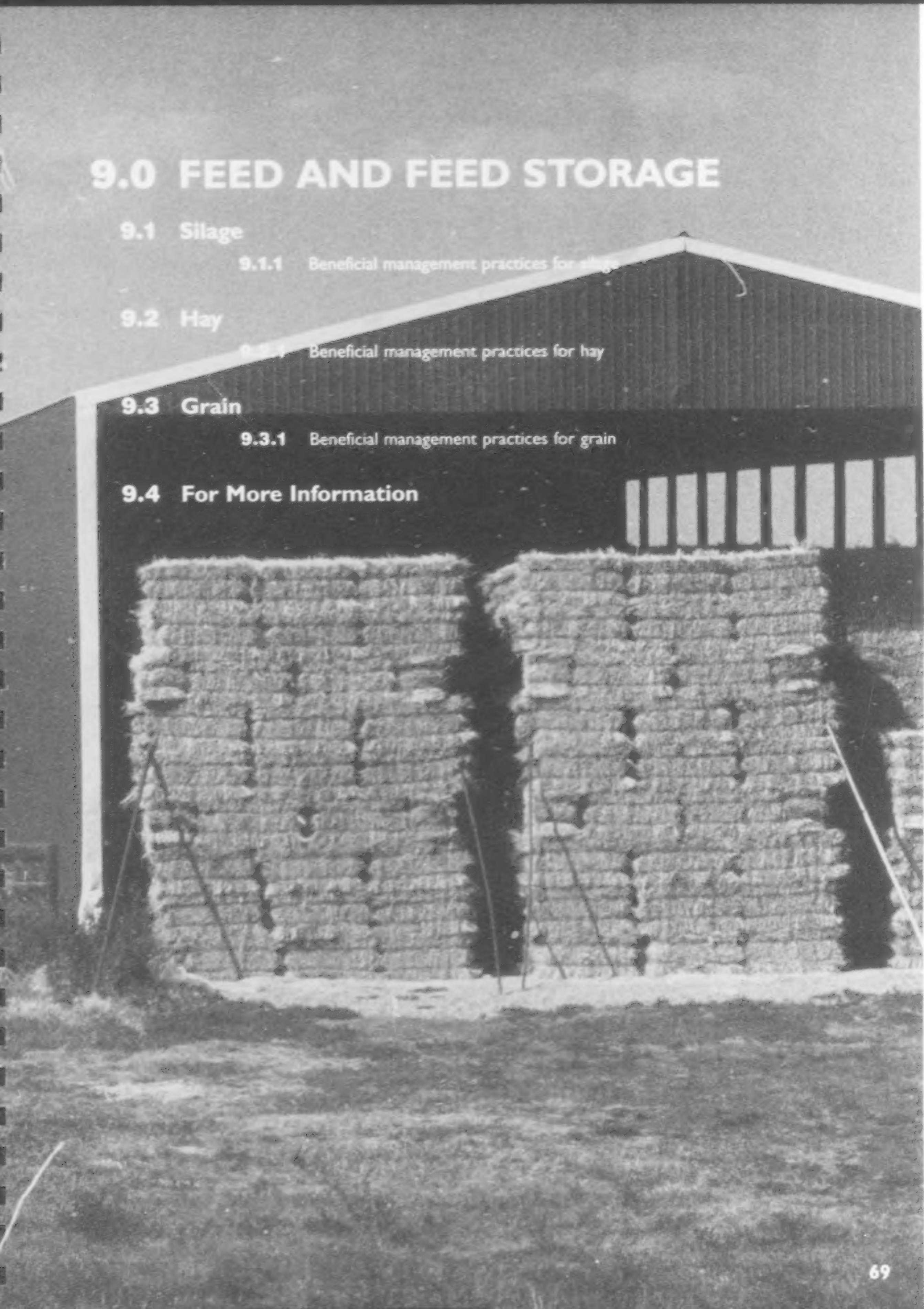
Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Controlling Wildlife Damage in Direct-Seeding* Agdex 519-16.
- *Control of Pocket Gophers and Ground Squirrels* Agdex 684-1.
- *Mice and their Control* Agdex 683.
- *Preventing Bird Damage to Prairie Crops* Agdex 685-4.
- *The Richardson's Ground Squirrel (Prairie Gopher): Its Importance and Control* Agdex FS684.
- *Physical Control of Pests.*
- *Starlings and their Control.*
- *Principles of Biological Control.*
- *Crop Protection* Agdex 606-1.
- *Grasshoppers: Life Cycle, Damage Assessment and Management Strategy* Agdex FS622-27.

9.0 FEED AND FEED STORAGE

9.1 Silage
  9.1.1 Beneficial management practices for silage
9.2 Hay
  9.2.1 Beneficial management practices for hay
9.3 Grain
  9.3.1 Beneficial management practices for grain
9.4 For More Information



9.0 FEED AND FEED STORAGE

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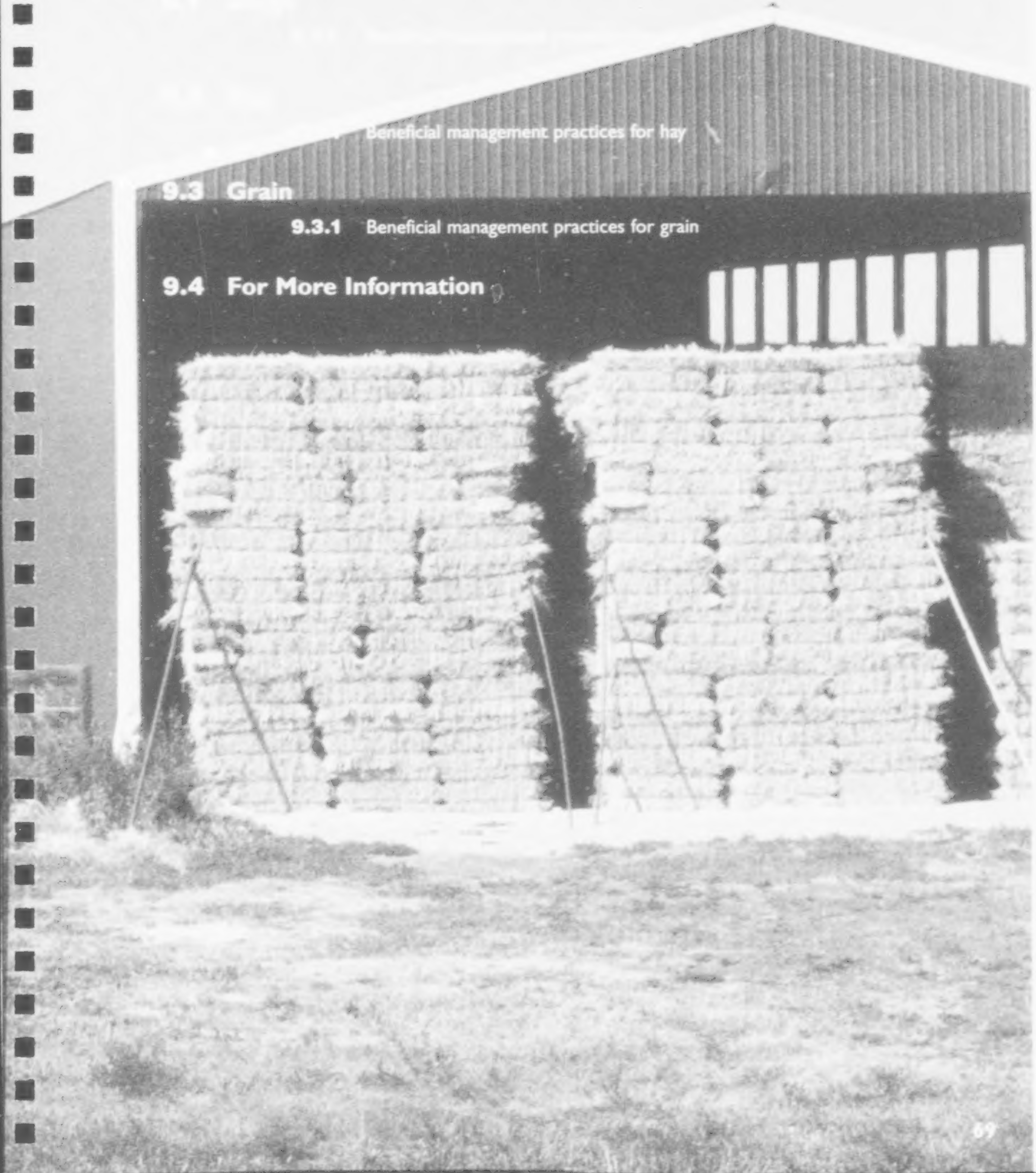
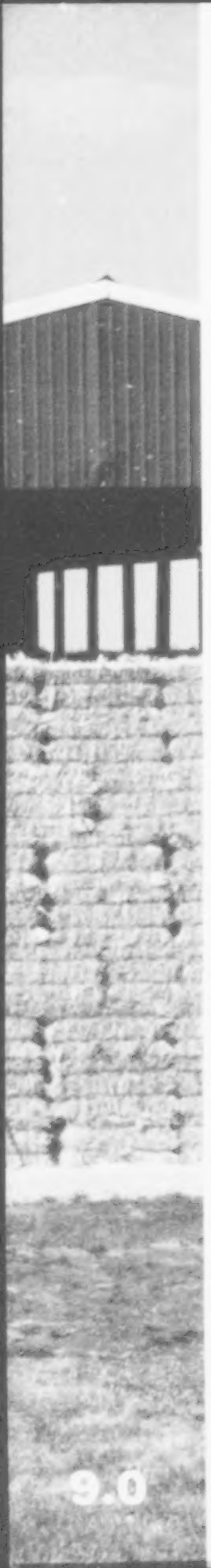
[illegible] Beneficial management practices for hay
9.3 Grain
9.3.1 Beneficial management practices for grain
9.4 For More Information





9.0 FEED AND FEED STORAGE

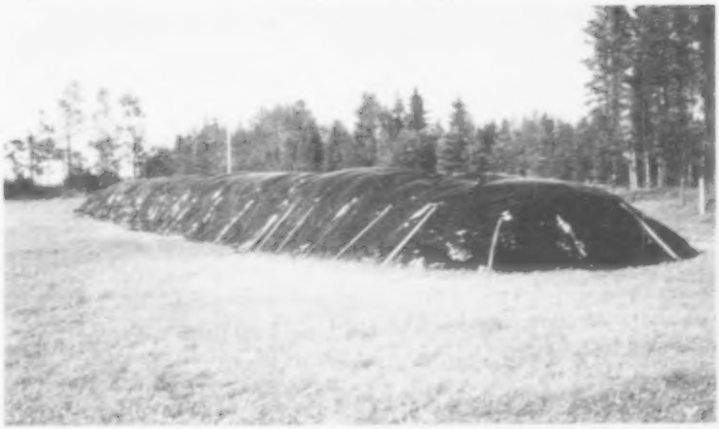
Grain, hay and silage need to be properly stored to protect water quality, reduce fly populations and maintain feed quality. Leak-proof covers are essential for grain and silage, and are preferred for hay. Storage should not be in a location where water runs or ponds. Storage structures need to be secure and stable.

9.1 Silage

Silage produces a palatable, nutritious feed supply that can be harvested in almost all weather conditions. It is a good way to salvage hail-damaged, frozen or weedy crops, and can be used as an environmentally friendly form of weed control. Fields intended for silage can be planted to a variety of crops and crop mixes, which increases the biodiversity of plant life.

Handle and store silage properly to prevent seepage. Silage seepage contains high concentrations of nutrients and acids that can increase the levels of ammonia, nitrate and iron in ground and surface water. Silage seepage can enter surface water by runoff or groundwater by infiltration.

Figure 9.1 **Silage Storage**



9.1.1 Beneficial management practices for silage

When selecting a site for storing silage, investigate soil, topography and the water table to determine the environmental risk to nearby surface and groundwater.

- Select a storage facility site well away from watercourses and flood plains, and more than 100 metres (330 feet) from a water source.
- Ensure that the floor of the pit and the sides are in good condition and leak-proof. A clay liner or concrete pit may be necessary.
- Ensure that the cover has no holes to prevent rain entering the silage.
- Ensure that any run-on upslope of the silage storage is redirected around the site.
- Use a properly designed and well-maintained seepage collection system to prevent runoff entering water bodies.
- Do not store silage in a flood plain.
- Do not store silage in an area with a high water table.
- Harvest silage crops at moisture levels below 65 percent to minimize seepage.

9.2 Hay

Importing hay from another operation can introduce non-native weed species. These non-native species can impact weed control and biodiversity. When locating hay storage, take into account the proximity of water bodies and accessibility to wildlife. Nutrients leaching from the feed can affect water quality.

9.2.1 Beneficial management practices for hay

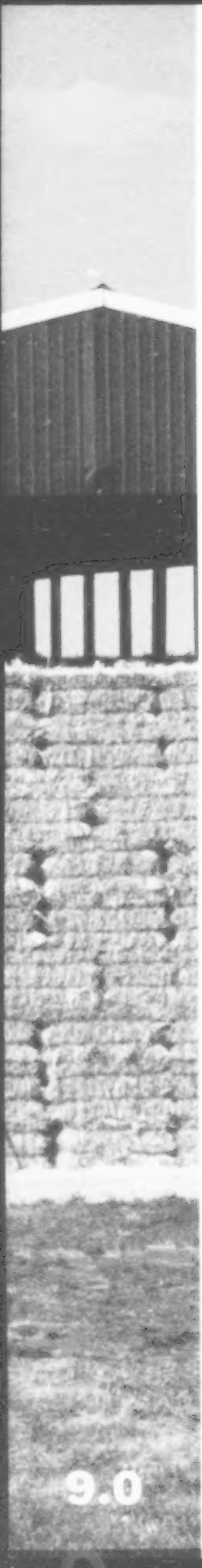
- Purchase hay that has been certified under the Provincial Certified Weed-Free Hay Program as being weed-free.
- Inspect the hay field while it is still in the stand to identify weeds and determine severity.
- Feed suspect hay in specific control areas during the feeding period and inspect the area for weeds in subsequent years.
- If possible, feed suspect hay on grain land that will be blanket-sprayed during grain production. Most weeds are susceptible to cultivation and crop herbicides in their juvenile growth stage.
- Wait a few days after feeding weedy hay before moving cattle to a new feeding area to ensure that undigested seeds in manure remain in the control area.
- Locate the stack away from watercourses or flood plains.
- Cover bales to reduce rotting and nutrient leaching.
- To reduce fire hazards, store hay away from buildings, shelterbelts and power lines.

9.3 Grain

When choosing a location for grain storage, take into account the proximity to water bodies and rodent accessibility. Leaching from the grain can affect water quality and the quality of the grain. Take special care when storing leftover treated seed on the farm.

9.3.1 Beneficial management practices for grain

- Purchase feed grain from reputable farms that use sound weed management programs.
- When possible, inspect the grain while it is still in the stand to identify weeds and determine severity.
- Store grain in waterproof, rodentproof facilities to prevent rotting and fecal contamination. Check the facility regularly for holes and cracks.
- Thoroughly clean emptied bins.
- Store leftover seed in a contained bin to prevent contamination of ground and surface water.



MANAGING FOR *FUSARIUM GRAMINEARUM*

The primary cereal disease affecting the Alberta livestock industry is caused by the fungus, *Fusarium graminearum*. Fusarium Head Blight (FHB) is the most destructive fungal disease of barley and wheat in Canada. The severity of FHB in cereal crops in western Manitoba and eastern Saskatchewan has caused major economic losses to crop producers and the grain export industry. *F. graminearum* greatly decreases yield and seed quality, and produces mycotoxins (deoxynivalenol and zearalenone).

When infected grain is fed to cattle, the fungus is destroyed by the cow's digestive system. Because a high percentage of Alberta's barley crop is fed to beef cattle, the bulk of *F. graminearum* in infected feed grain is destroyed.

But the concern for Alberta's industry centres on spilled grain, infected cereal seed, straw and grass hay, which can allow *F. graminearum* to escape into Alberta's agricultural land base. Take immediate action, where appropriate, to reduce the risk of spreading FHB.

To prevent the introduction and spread of FHB, follow strict measures during the transport, loading, unloading, storage and feeding of cereal grains. Although the fungus is mostly harboured in the seed of the plant, enough exists in the straw to allow its introduction to clean land. When using straw for feed or bedding, take extreme caution. **Do not use infected straw under any circumstance because of the long-term effects on crop production and the cost to the industry.**

Before purchasing straw from infected areas of Western Canada, ensure the straw is from fusarium-free land. Discuss the status of the straw with the source producer and, if necessary, get a sample of the corresponding grain and test it for the fungus. Several labs in Western Canada can accurately test for fusarium. Do not use the straw or grain if it is infected.

Cover all loads of grain during transport to prevent the spread of disease, and thoroughly clean up when loading and unloading.

Contact a local Agricultural Fieldman for further assistance regarding the purchase of fusarium-free grain and straw.

9.4 For More Information

Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Alberta Feedlot Management Guide, 2nd edition.*
- *Nutrient Content of Hays and Silages.*
- *Hay Storage – Planning and Design Guidelines.*
- *Management of Hay Imported into Alberta.*
- *Alberta Certified Weed-Free Hay Program.*
- *Alberta Fusarium graminearum Management Plan 2002* Agdex 110/632-3.
- *Management of Cereal Grain in Storage.*
- *On-Farm Grain Handling and Storage Layouts* Agdex 732.16.

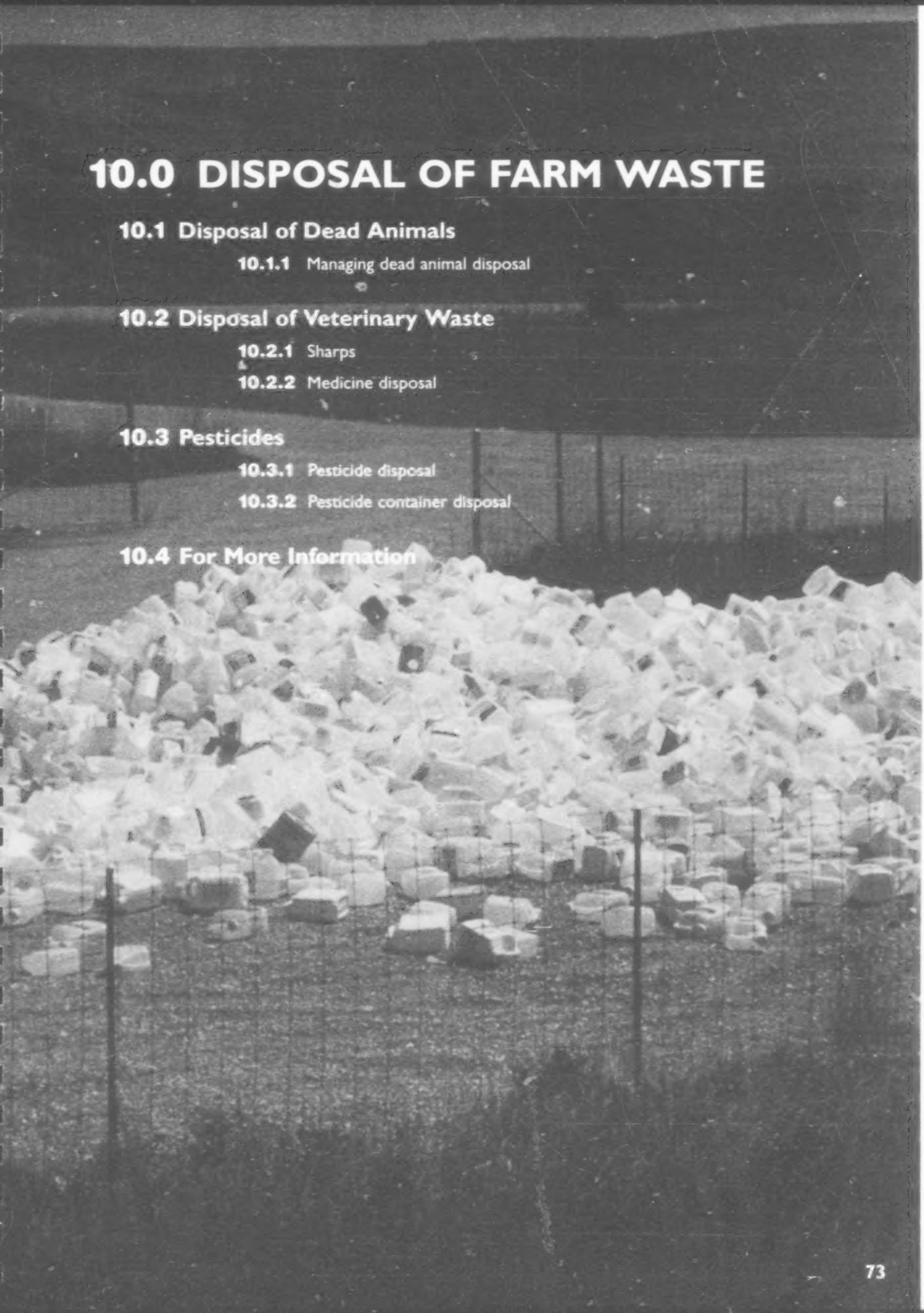
10.0 DISPOSAL OF FARM WASTE

10.1 Disposal of Dead Animals
  10.1.1 Managing dead animal disposal

10.2 Disposal of Veterinary Waste
  10.2.1 Sharps
  10.2.2 Medicine disposal

10.3 Pesticides
  10.3.1 Pesticide disposal
  10.3.2 Pesticide container disposal

10.4 For More Information



10.0 DISPOSAL OF FARM WASTE

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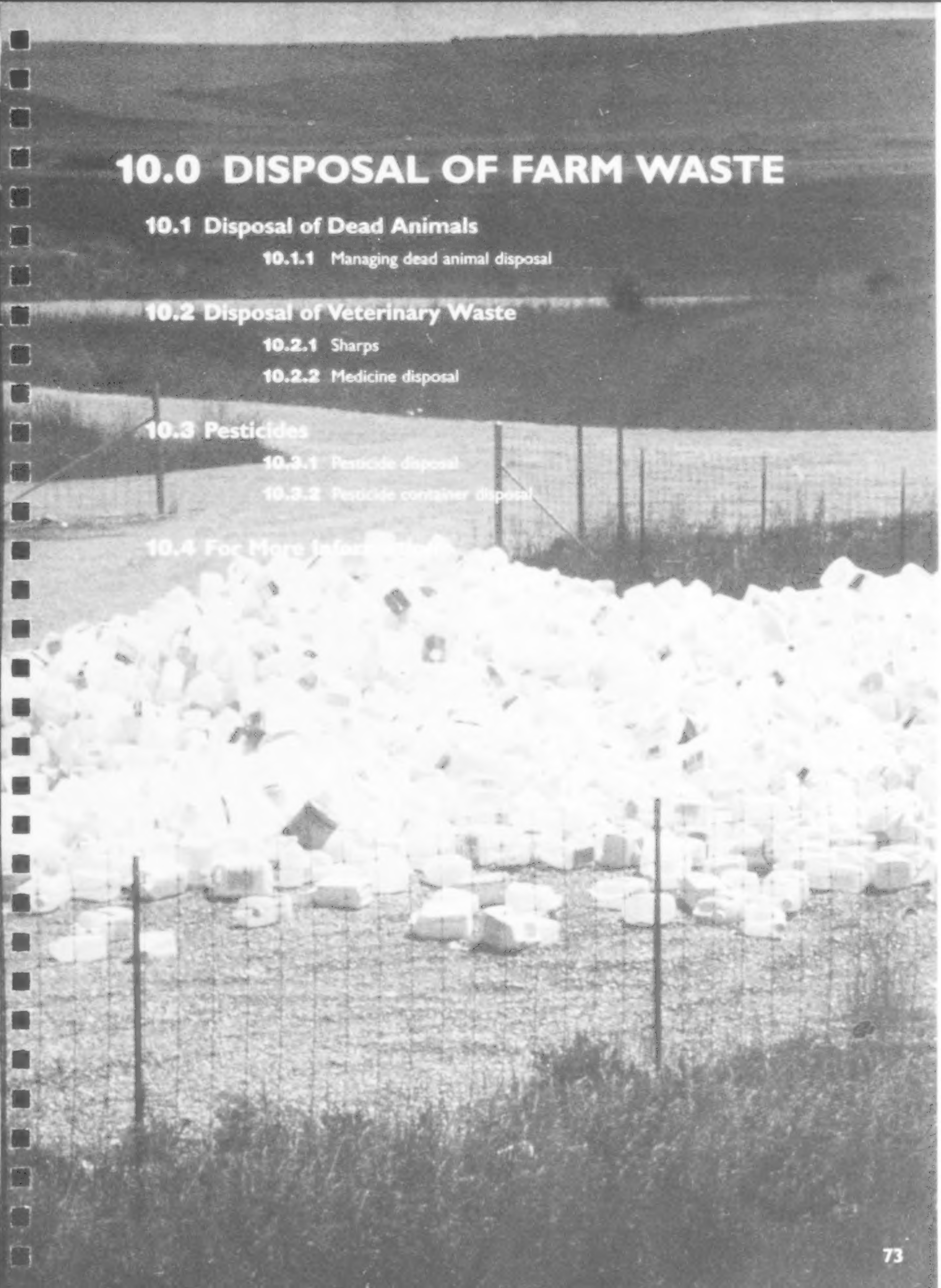
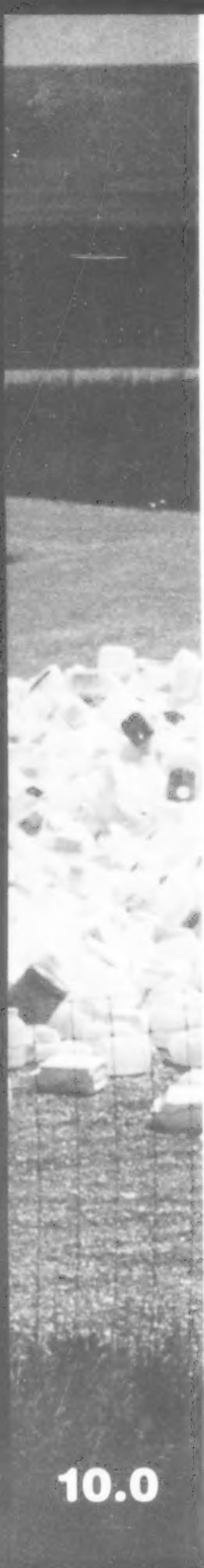




10.0 DISPOSAL OF FARM WASTE

Farm waste must be managed with caution prior to disposal. Securely store waste in a closed, and possibly locked, area or container to ensure safety for family, livestock, pets and wildlife.

On-farm dumps, though generally not recommended, can be used exclusively for the disposal of small amounts of inert materials. The dump should be located on a naturally dry site, and be fenced to prevent entry by children and animals.

10.1 Disposal of Dead Animals

Some death loss will occur on cow/calf operations, no matter how well they are managed. Disposing of dead animals quickly and effectively is important to reduce the risk of disease. It is also important in maintaining good neighbour relations. Carcasses can be a source of disease if scavenged by wildlife or pets. Some of these diseases can then be passed back to livestock or even humans. Carcasses are also unsightly, a source of odour and a breeding site for flies.

The disposal options permitted in Alberta are:

- Transportation to a rendering plant for disposal.
- Burial in farm pit.
- Burning within regulations.
- Composting.
- Sending to a Class I or II landfill.
- Natural disposal (except for animals that have been euthanized with drugs and chemicals).

Disposal of dead animals must occur within 48 hours of death unless the carcass is frozen.

Disposal of any animal suspected to have died from a reportable disease must be done in accordance with the *Health of Animals Act* (Canada).

Refer to the *Destruction and Disposal of Dead Animals Regulation* under the *Livestock Diseases Act*, for details on regulations pertaining to the disposal of dead animals. A copy of this Regulation may be obtained from the Alberta Queen's Printer, www.qp.gov.ab.ca/custom_page, or through the AAFRD Web site at www.agric.gov.ab.ca/navigation/department/acts/index.html.

10.1.1 Managing dead animal disposal

Rendering

Dead animals must be picked up by rendering plants within 48 hours of death. The carcass must be stored until pickup.

When storing carcasses:

- Select a site for the storage area close to the farm entrance to minimize the need for collection vehicles to enter the property.
- Use an area that will minimize the spread of disease. For example, do not store the carcass near a waterway or water body or where it will be easily scavenged.
- Use special storage bins or refrigeration until the carcass can be picked up.

Natural disposal

Natural disposal refers to scavenging. Do not use this method when the animal is known or suspected to have died from an infectious disease that can be spread by scavengers or insects, or from a reportable disease. In these cases, dispose of mortalities in accordance with veterinary advice. Natural disposal is also not appropriate for animals that have been euthanized.

The *Destruction and Disposal of Dead Animals Regulation* contains the following guidelines for natural disposal:

- The total weight of the carcasses disposed at any one site must not exceed 1,000 kilograms.
- There must be at least 500 metres between disposal sites.
- The site must be:
  - 500 metres from wells, waterways and high water marks of lakes.
  - 25 metres from the edge of a coulee, major cut or embankment.
  - 400 metres from any livestock facility, including pastures that are not owned or leased by the owner of the animal.
  - 400 metres from a residence.
  - 400 metres from a road allowance.
  - 400 metres from a provincial park, recreation area, natural area, ecological reserve, wilderness area or forest recreation area.
- The site must not create a nuisance.

Burial

Bury mortalities promptly to control odour, insects and scavenging. Screen the burial area from view with trees, shrubs or fences, and locate it some distance from livestock.

The *Destruction and Disposal of Dead Animals Regulation* contains the following guidelines for burial:

- The total weight of carcasses in a burial pit must not exceed 2,500 kilograms.
- The pit must be:
  - 100 metres from wells, waterways and high water marks of lakes.
  - 25 metres from the edge of a coulee, major cut or embankment.
  - 100 metres from any livestock facility, including pastures that are not owned or leased by the owner of the animal.
  - 100 metres from a residence.
  - 300 metres from a primary highway.
  - 100 metres from a secondary highway.
  - 50 metres from any other road.
- The pit must be covered with:
  - A minimum of one metre of compacted soil.
  - A wooden or metal lid that is designed to exclude scavengers. Apply quicklime to the carcass in sufficient quantities to control flies and odour.
- The bottom of the pit must be at least one metre above the seasonal high water table.

Burning

Burning mortalities must be done in accordance with the *Destruction and Disposal of Dead Animal Regulation*. This typically requires a certified, commercial quality incinerator that produces a long term, high temperature burn, sufficient to completely dispose of the carcass. For more information, refer to the *Substance Release Regulation* and the *Code of Practice for Small Incinerators* from Alberta Environment.

Composting

Composting is a controlled, natural biological process of decomposition of organic materials in a predominately aerobic environment. Composting of livestock mortalities is possible and is practised in Alberta today. Six to nine months is required to properly compost a bovine carcass. The compost pile should be turned every three months to ensure proper decomposition. Any animal parts exposed as a result of the turning must be covered, as per the regulations below.

The *Destruction and Disposal of Dead Animals Regulation* contains the following requirements for composting mortalities:

- The site must be:
  - 100 metres from wells or other domestic water intakes, streams, creeks, ponds, springs and high water marks of lakes.
  - 25 metres from the edge of a coulee, major cut or embankment.
  - 100 metres from any residences.
  - 100 metres from any livestock facilities, including pastures, situated on land owned or leased by another person.
- The site must be designed in a manner that will exclude scavengers.
- Each animal part must not exceed 100 kilograms.
- The maximum volume of the animals or parts of them must not exceed 25 percent of the total compost pile.
- The animals or parts of them must be covered by at least 15 cm of composting material.

Research is currently underway to determine if animals or animal parts larger than 100 kilograms can be properly composted.

10.2 Disposal of Veterinary Waste

10.2.1 Sharps

Sharps are veterinary and laboratory materials capable of causing cuts or punctures and include needles, syringes, scalpel blades, slides, coverslips, pipettes, broken glass and empty or expired pharmaceutical containers. There is a risk of needle stick injuries or cuts when these materials are not handled or disposed of properly. Certain drugs or vaccines may cause reactions or infections if they are present on broken glass or used needles that break the skin. Blood on used needles, collection tubes or other equipment, may contain viruses or bacteria that can cause illness following a cut or needle stick injury. There are currently no regulations covering the disposal of sharps in agriculture.

To safely dispose of sharps:

- Separate sharps from other waste. Injuries can occur when handling sharps on the farm or at the landfill.
- Use a labelled rigid container for disposal of sharps.
  - Use a puncture-proof container with a sealed lid for needles and surgical blades. Special containers can be obtained from many local veterinary clinics. Containers must be labelled clearly as containing sharps and must not be used for recycling. A plastic jug with a narrow mouth or a pail with a narrow opening in the lid also work well. Do not use containers that allow easy access to contents. Ensure children or animals cannot remove the lid.
  - Use a pail or other rigid container for pharmaceutical bottles and syringes.
- Use disposal facilities that accept veterinary waste. This may include a local vet clinic, hospital or waste disposal company. Contact a local vet clinic or hospital for information. Labelled sealed containers can also be taken to Class II landfills that accept medical waste.
- Do not burn disposal containers.

10.2.2 Medicine disposal

Medicines may need to be disposed of for various reasons including expiry, spoilage, or simply because they are no longer needed. There are two classes of expired medicines - unused (unopened) and used (opened). Unused expired drugs can be returned to the point-of-purchase; many manufacturers will take them back for disposal. Used, expired drugs can be discarded in the same way as sharps. Modified live virus vaccines should be rendered non-infectious before disposal to prevent the potential of the virus infecting workers or animals. This can be done by freezing, autoclaving, burning or adding bleach to the bottle. When disposing of used or unused expired medicines, do not attempt to empty or wash bottles - discard them with their contents. Consult a local veterinarian or pharmacist to learn more about medicine disposal.

10.3 Pesticides

Pesticides include herbicides, fungicides, insecticides, rodenticides, pesticide-treated seed and topical parasiticides (pour-on or powders for treating parasites).

10.3.1 Pesticide disposal

Carefully dispose of unwanted or expired pesticides. Pesticides are hazardous wastes and cannot be disposed of in sanitary landfills or by burning. Offer unused pesticide supplies with proper use directions to neighbours. Pesticides that have no further use must be disposed of as hazardous waste. Names of companies that are licensed to handle hazardous waste can be obtained from Alberta Environment's Recycle Information Line at 1-800-463-6326. Unused products can also be returned to the dealer.

10.3.2 Pesticide container disposal

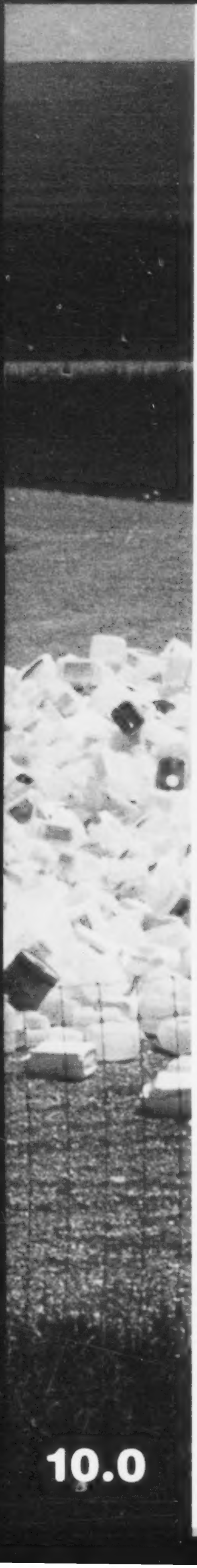
Empty pesticide containers must be disposed of carefully. Unrinsed empty pesticide containers have the potential to contaminate ground and surface water, and can be toxic to fish and wildlife. Under the *Alberta Environmental Protection and Enhancement Act*, non-refillable plastic or metal pesticide containers (restricted, agricultural and industrial products) must be disposed of at a pesticide container collection site. A list of pesticide container disposal sites in Alberta and their hours is available from each municipality, in the *Crop Protection Manual* and from Alberta Environment.

Containers must be triple rinsed or pressure rinsed and dry before disposal. In most cases, triple rinsing leaves plastic, metal or glass pesticide containers more than 99 percent free (less than 1 ppm) of residues. For details on rinsing, consult the *Crop Protection Manual*.

Recycle paper and cardboard outer wrappings at a recycling centre. Any cardboard that has been contaminated by a container rupture, accidental spill or improper handling procedure should be disposed of as a hazardous waste. Evidence of cardboard contamination should be obvious – signs of exposure to liquid, powder or granules, or a strong chemical odour. Dispose of these materials at a sanitary landfill. Do not burn paper bags or cardboard containers. Some pesticide container sites have bins or separate areas for collecting these outer packaging materials.

Containers from topical parasiticides (e.g. pour-on compounds or powders for lice and mange) should be disposed of in a safe manner. These compounds can be toxic to fish, wildlife, other livestock and humans. These products should be kept out of waterways and streams and not be allowed to contaminate foods or feeds. Some products are controlled under the *Pest Control Products Act* and it is an offence to use them other than as directed on the label.

Containers should not be reused and empty containers should be made unsuitable for re-use. For specific information on the disposal of unused and unwanted product and the cleanup of spills, contact the regional office of Conservation and Protection, Environment Canada.



10.4 For More Information

Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Livestock Mortality Management (Disposal)* Agdex 400/29-1.
- *Livestock Mortality Burial Techniques* Agdex 400/29-2.
- *Crop Protection Manual* Agdex 606-1.

Alberta Environment
Action-on-Waste Recycle Information
1-800-463-6326

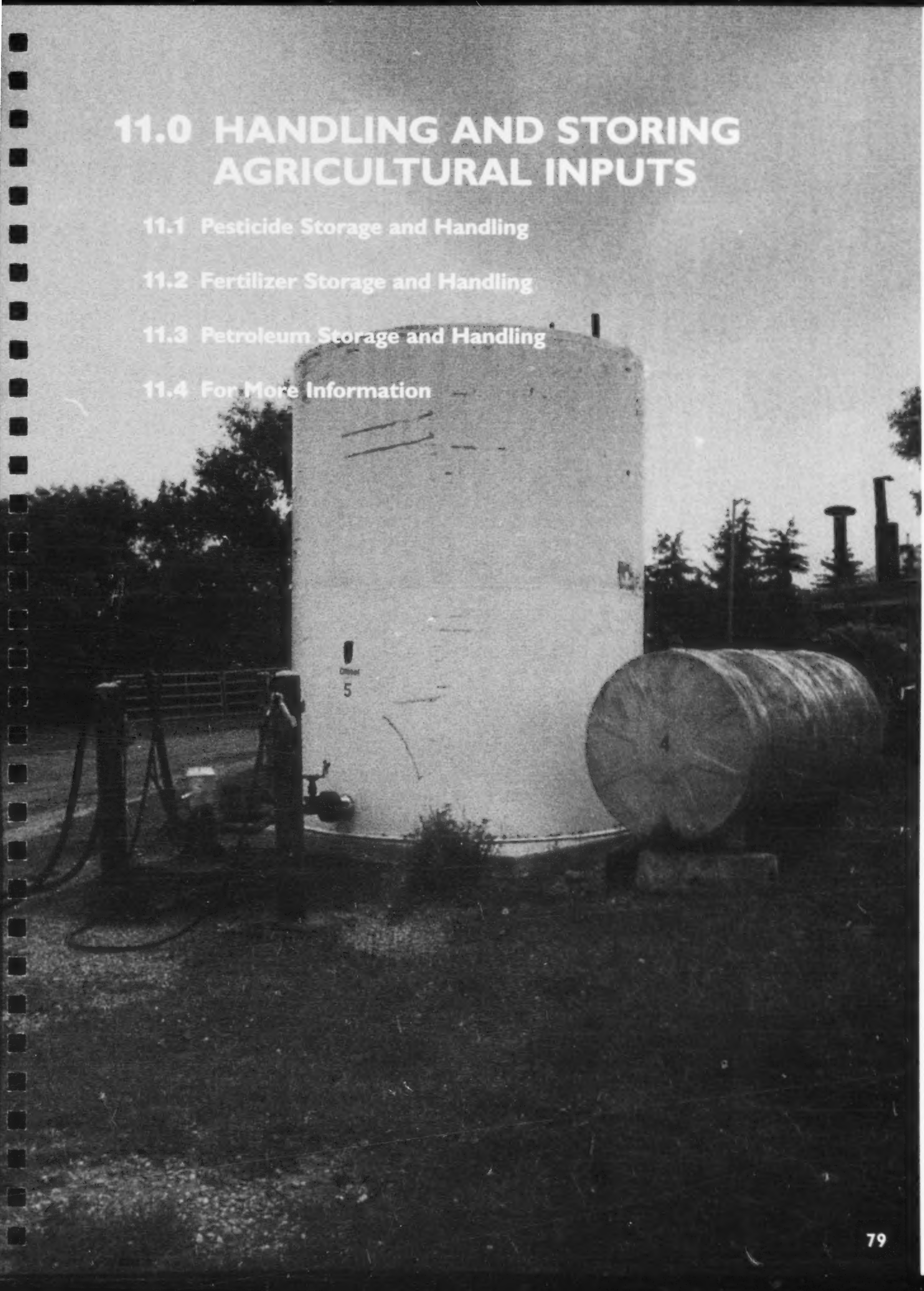
11.0 HANDLING AND STORING AGRICULTURAL INPUTS

11.1 Pesticide Storage and Handling

11.2 Fertilizer Storage and Handling

11.3 Petroleum Storage and Handling

11.4 For More Information



11.0 HANDLING AND STORING AGRICULTURAL INPUTS

Agricultural inputs include fertilizer, pesticides and petroleum. When handling these products, maintain as great a distance as possible from any water source. All products should be stored safely and securely.

11.1 Pesticide Storage and Handling

Improper pesticide storage can result in spillage, which can contaminate soil and water, and can harm humans, animals and plants. When mixing and loading pesticides, follow proper procedures and take extra caution.

General Storage

- The best practice is to avoid storing any pesticide on the farm. If on-farm storage is necessary, the amount of product stored must not exceed 20 litres or 20 kilograms. Storage should not exceed one month and should be in a signed and secure facility.
- Use pesticides immediately. If they cannot be used immediately, store pesticides at a supplier. Suppliers handle and store pesticides as hazardous goods. This eliminates the liability of on-farm accidents.
- Consult labels for specific storage instructions. Do not store near food, feed, seed, potable water or protective equipment.
- Store and handle pesticides at a distance greater than 30 metres (100 feet) from a water body and 90 metres (300 feet) from a water well. This distance also applies when mixing pesticides.
- Return unopened product to the dealer for a refund.
- All original containers must retain manufacturer's labels and any supplementary containers must also be properly labelled.

The best storage facility will contain spills, and eliminate the potential of soil and water contamination.

Key considerations for a storage facility are:

- The facility should have an impermeable floor (i.e. sealed concrete).
- Use curbs to contain leaks.
- Avoid the use of a floor drain. If using a drain, collect drainage in a proper holding tank.
- Use an overpack container if product container is leaking. Pack in a larger container and surround with leak collection material (i.e. kitty litter). An overpack container must be large enough to fully contain a pesticide container.
- Site should be downslope from all water sources.
- Site should be more than 90 metres (300 feet) from a water well.
- Site should be more than 150 metres (500 feet) from a water body.

Emergency Plan

Producers must have an emergency plan for dealing with leaks or spills at the storage site or during handling. This written plan should include the location of emergency equipment, emergency telephone numbers, cleanup methods and steps that must be followed.

Have the following cleanup material readily available:

- Absorbent material (i.e. kitty litter).
- Shovel.
- Waste container.
- Protective equipment, including rubber gloves and rubber boots.

Mix and load pesticides properly to minimize the risk of water or soil contamination. On-site mixing is the best practice. Bring water in with a nurse tank. For field mixing and loading, move the mixing site with each application.

Permanent Storage

- The mixing and loading area should be able to contain spills and drips. It should have an impermeable floor and curbs to contain product.
- It should have a sump to collect product.
- It should be capable of containing 125 percent of the sprayer's tank volume.
- The pad should be covered to eliminate increased volumes from run-on and precipitation or be designed for these volume increases.

- The tank should be filled from the top with an air gap of at least 15 centimetres (6 inches). If another method is used to fill the tank, there should be a backflow prevention device on the hose.

For all pesticide handling situations:

- Ensure the filling operation is supervised continuously for the duration of the procedure.
- Have spill containment and cleanup equipment ready.
- Have emergency communication equipment available and ready to use.

When changing pesticide products, clean the tanks to prevent cross-contamination between products.

- Rinsate can be used as mix water for future applications when the same chemical is being applied.
- Rinsate can be applied to non-crop areas (i.e. farmsteads, waste areas) away from surface water, water wells, septic systems and other sensitive areas (i.e. gardens, shelterbelts).
- Rinsate can be applied for total vegetation control or used as a second spray over treated areas.

Transporting Pesticides

Pesticides must be secured during transportation. Do not transport pesticides with human or animal food, household furnishings, toiletries, clothes, bedding or similar items.

11.2 Fertilizer Storage and Handling

As with pesticides, storing and handling fertilizers must be done with extra caution. Leaks or spills can contaminate soil and water, and can harm humans, animals and plants.

Store all fertilizer in a secure storage facility. Ideally this means in a locked and fenced area, locked building or storage structure separate from all other activities.

Generally, it is best not to store any fertilizer on the property other than what is needed for immediate use. This reduces the potential of a spill or other accident. If product must be stored, the amounts stored must not exceed the following:

Dry – Less than 1 tonne (2,205 pounds).
Wet – Less than 200 litres (44 gallons).

Storage facilities should:

- Have a locked, fenced area, building or storage structure away from areas where other farm activities could damage containers or cause a fertilizer spill.
- Have sight gauges and lock-on valves if liquid fertilizer is being stored.
- Have appropriate signage indicating contents, in case of fire.
- Be located away from water sources. Ensure that the distance to water wells is more than 100 metres (300 feet) and the distance to water bodies is more than 20 metres (60 feet).

Producers should have an emergency plan in place in case of leak or spill. This written plan should include the location of emergency equipment, emergency telephone numbers, cleanup methods and steps to follow.

Store dry fertilizers in a building, or in an epoxy-lined bin situated on an impermeable surface, such as sealed concrete. If using a permanent mixing and loading area, it should be on an impermeable pad and be swept after use.

For liquid fertilizers, secondary containment of the storage is necessary. A secondary containment should be constructed from an impermeable material, either a synthetic or clay liner.

If using a permanent mixing and loading area, ensure that spills and leaks can be collected and contained. The water supply should have a backflow prevention device or have a 15 centimetre (6 inch) air gap above the tank. When filling the tank, it must be constantly supervised. Use a closed handling system when possible.

Monitor storage sites regularly and inspect all tanks, valves and plumbing.

11.3 Petroleum Storage and Handling

Any fuel or lubricant can cause problems if it contaminates soil or water. Under Alberta's *Environmental Protection and Enhancement Act,* all gasoline and diesel fuel spills and leaks of 200 litres (44 gallons) or more must be reported to Alberta Environment. Spills of a lesser amount must be reported if the spill is causing, has caused or may cause an adverse effect on the environment. A leak or spill of any amount into a watercourse, water body or groundwater must also be reported. Cleanup costs can be applied as a penalty.

Currently, the *Alberta Fire Code: 1997* governs the storage and handling of petroleum products. This *Code* is administered by Alberta Municipal Affairs. On-farm storage and handling of petroleum products are exempt. However, the following suggested practices serve as a reasonable set of guidelines for Alberta farms.

Liquid petroleum products, such as gasoline, diesel fuel and kerosene, must be stored safely to prevent spills and leaks. These products can move quickly through the soil and into groundwater. A leak of one drop per second can release about 900 litres (200 gallons) of gasoline into the groundwater in one year. It only takes a few litres of gasoline to severely contaminate a farmstead's drinking water supply. It is difficult to detect low levels of fuel contamination in water because it is almost impossible to smell or taste any petroleum product. Water that seems pure may be contaminated and can affect human health.

Explosions are another potential danger. Explosions can occur from leaking vapours that collect in basements, sump pits or other underground structures.

The following guidelines are suggested for storing petroleum products:

- Protect aboveground tanks, underground storage tanks and piping against corrosion to prevent leaks.
- Install tanks in accordance with the *Alberta Fire Code.*
- Lock all fuel tanks when not in use. This reduces the risk of spills caused by vandalism and theft.
- Mount tanks at ground level or support on concrete. This provides at least a two-hour fire resistant rating.
- Keep the area around the tank free of vegetation.
- All storage tanks should have secondary containment, such as dikes or double-walled tanks, to contain spills.
- Protect all pumps, lines and tanks to prevent collision damage. Install bollards (barriers constructed of a sturdy material, such as steel piping filled with cement) close to fuel tanks to guard against collision damage. Ensure fill-up hoses are long enough so vehicles and farm equipment are kept at a safe distance from the tanks.
- Install anti-siphon valves between the pump and the tank to prevent the tank from draining if the line breaks.
- If no dike is present, locate tanks downslope from buildings, grain storages, water wells and surface water so any spilled or leaked fuel drains away from these.

Emergency Plan

Producers should have an emergency plan for dealing with leaks or spills. This written plan should include the location of emergency equipment, emergency telephone numbers, cleanup methods and steps that must be followed.

Contact Alberta Environment at 1-800-222-6514 if a spill or leak occurs.

If an aboveground spill or leak occurs:

- Stop the flow of fuel.
- Contain the spilled fuel with earth or another suitable absorbent material.
- Shovel the contaminated earth or absorbent material into a clean container.
- Dispose of contaminated cleanup materials in accordance with Alberta Environment guidelines.

For lubricant leaks or spills on floors, clean up using sawdust, rags or other absorbent material. Spills on soil should be excavated. In both cases, the soil or absorbent material must be disposed of in accordance with Alberta Environment guidelines.

Dispensing Fuel

- Fuel can be dispensed using hand or electric pumps, but must take place under constant supervision. Gravity feed is not acceptable. The dispensing tool must also be ULC and CSA approved.
- Close valves on tank discharges after use to prevent leakage through the hose or nozzle.
- When filling containers such as jerry cans, ensure they are in an upright, stable position.

Storage Facility Monitoring

- Keep fuel lines, hoses, valves and nozzles in good repair.
- Inspect overhead tanks and the area around the tanks for leaks twice monthly.
- Monitor the volume of fuel in on-ground and below-ground tanks to detect leaks.
- It is important to monitor fuel storage for leaks. The best way to determine if a leak exists is to meter fuel use and track the amount of fuel used.

Figure 11.1 **Separation Distance Guidelines for Fuel Storage**

Potential contamination to	Minimum distance from fuel storage	
	metres	feet
Water well	90	300
Water body	30	100
Any building	3	10
Source of ignition*	6	20
Another fuel tank	1	3
Propane cylinder	3	10
Propane tanks	6	20

* This includes sources such as motors and electrical sparks unless electrical sources meet the electric code.

11.4 For More Information

Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

- *Crop Protection Manual* Agdex 606-1.
- *Fertilizer and the Environment (Video).*
- *Storing and Handling of Fuel on the Farm* Agdex 769-8.

Alberta Environment
(780) 944-0313
www.gov.ab.ca/env

- *Pesticide Storage: Regulatory Requirements and Guidelines.*

Canadian Association of Agri-Retailers
(204) 989-9300
www.caar.org

- *Fertilizer Storage and Handling.*

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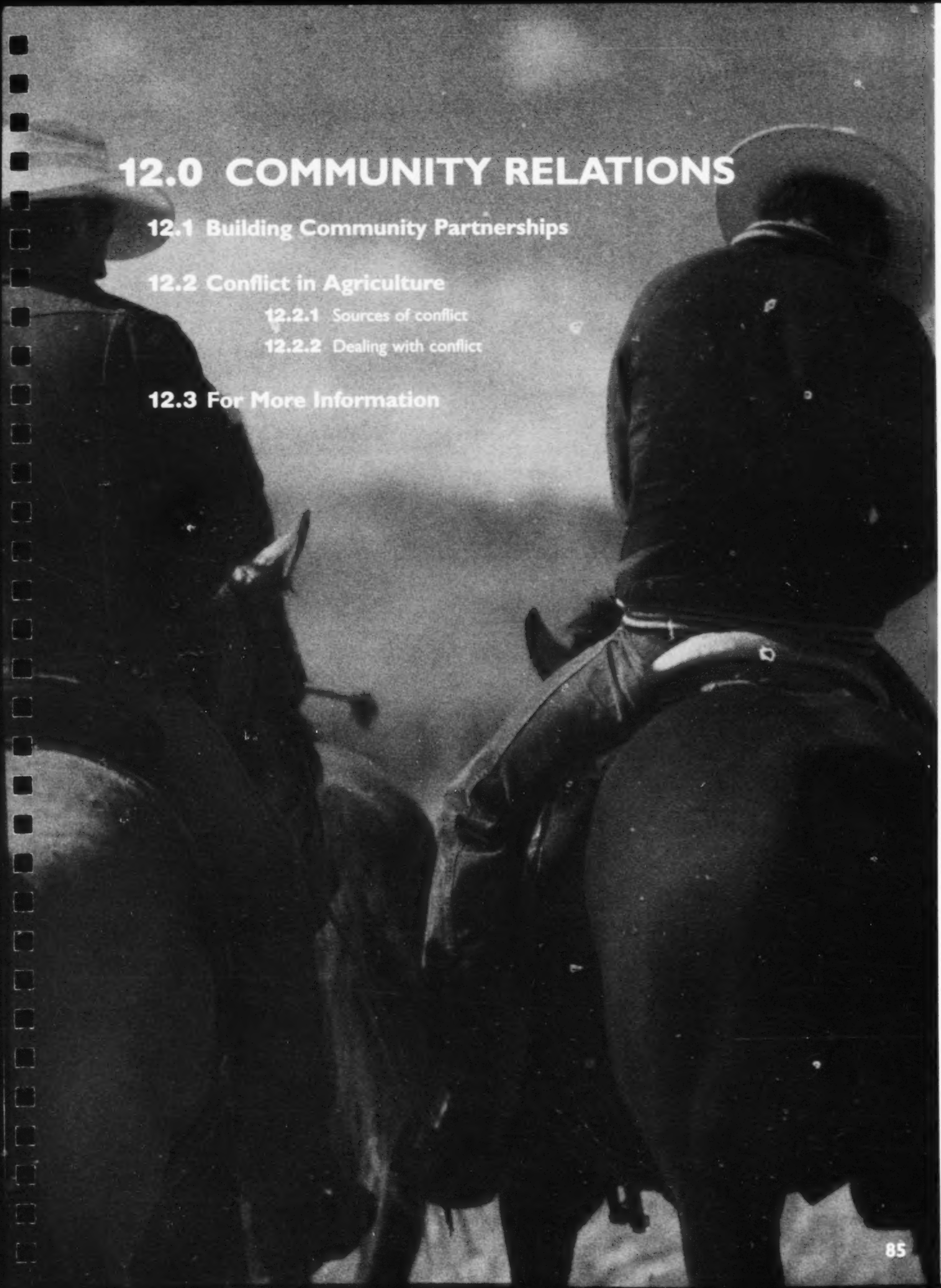
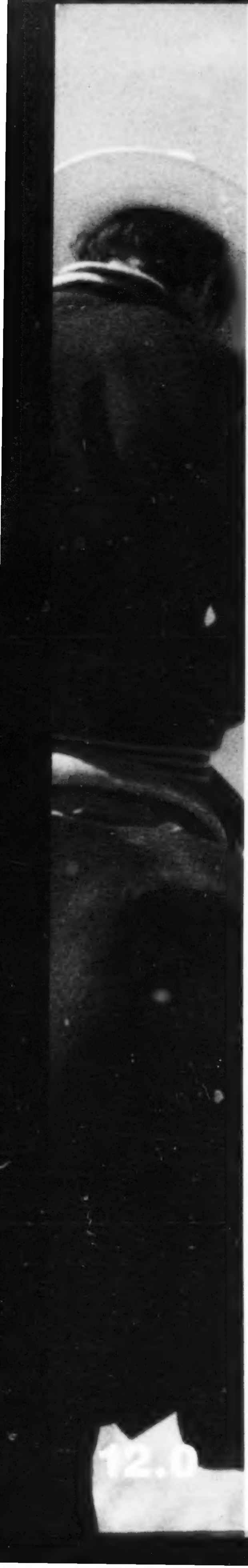


12.0 COMMUNITY RELATIONS

12.1 Building Community Partnerships

12.2 Conflict in Agriculture
  12.2.1 Sources of conflict
  12.2.2 Dealing with conflict

12.3 For More Information



12.0 COMMUNITY RELATIONS

Society's awareness of environmental, food safety and animal welfare issues means positive community relations are more vital than ever. Farmers need to communicate with their neighbours to build 'social capital,' which they can draw upon like a bank account when problems arise. Some neighbours may have less experience with agriculture operations or agriculture in general even though they live in an agricultural community. It is essential to get to know neighbours and inform them of farm practices they might not understand and may question. Being a good neighbour, having a public relations program for the farm and contributing to the community are good ways to build social capital.

To reduce the risk of conflict, communication with neighbours must be open, honest and thorough. This kind of communication is essential to lessen the impact livestock operations have on neighbours and to understand the concerns of neighbours. A complete understanding of community issues is an asset. Producers are in a better position if they are able to answer questions and concerns from neighbours, and if they have a complete understanding of the issues. Having the skills necessary to deal with differences of opinion can be the difference between resolving or prolonging the conflict. These skills include good communication, clarification, negotiation and facilitation.

12.1 Building Community Partnerships

Taking the time to establish relationships is challenging; however, it can result in fewer problems. When producers know their neighbours, it's easier to prevent conflicts. It also makes it easier to resolve conflicts when they do occur.

Community activities
A good way to improve relationships is through participation in community activities. Volunteering for a community group or joining a service club builds bridges between neighbours and creates a stronger sense of community.

Farm promotion
There are many activities that can promote the benefits of farming operations. Hosting a community picnic, baseball game or occasional open house will generate a better understanding of farms as businesses and may also help create new business relationships. Take the opportunity to promote examples of responsible management. These types of activities foster friendships and generate a better understanding of farm and ranch routines for people from other types of operations or those with no background in agriculture.

12.2 Conflict in Agriculture

In recent years, the number and intensity of conflicts facing farmers has risen sharply. Debated issues encompass a variety of environmental, political, economic and social issues. Public concern for human health and the environment has risen, as have inquiries into the agri-food industry and its practices.

A 1998 survey of Canadian farm organizations identified conflict arising from farm practices as one of the leading threats to the agriculture industry's future competitiveness. A study commissioned by the Canadian Farm Business Management Council (CFBMC) flagged issues management as one of the industry's top five priorities.

12.2.1 Sources of conflict

The biggest concern neighbours have about livestock production is that it will disrupt their quality of life. Producers can lessen their anxiety by exercising caution, consideration and common sense. While manure odour, animal and machinery noise, and other common agricultural practices may not be issues to the farming community, others may find these practices intrusive.

The following issues can be key sources of conflict for cow/calf producers:

- Manure odour. A common complaint concerns odour from the spreading of manure. Sound manure management is a necessity.
- Ground and surface water contamination. Depending on the topography of the land, the permeability of the soil and the quantity of manure, water contamination can be an issue. Proper placement of both watering and wintering sites can alleviate this concern.
- Riparian areas. These green zones are recognized as critical to water quality. Proper management can improve water quality and quantity, and increase forage production.
- Nuisance concerns related to the storage and handling of dead animals. Proper storage and disposal of carcasses is essential to minimize odours, flies and the transmission of disease to other animals. Carcasses should be disposed of or stored appropriately.
- Noise. Many rural areas have more non-agricultural landowners than ever before, and to them, some agricultural practices may seem foreign and offensive. When conducting noise-generating practices, such as cattle loading or doing field work at night, be courteous and let neighbours know what will be done and when. Being considerate prevents surprises and hard feelings.

12.2.2 Dealing with conflict

Sometimes conflict is unavoidable; however, it is important to resolve the conflict to the satisfaction of all parties.

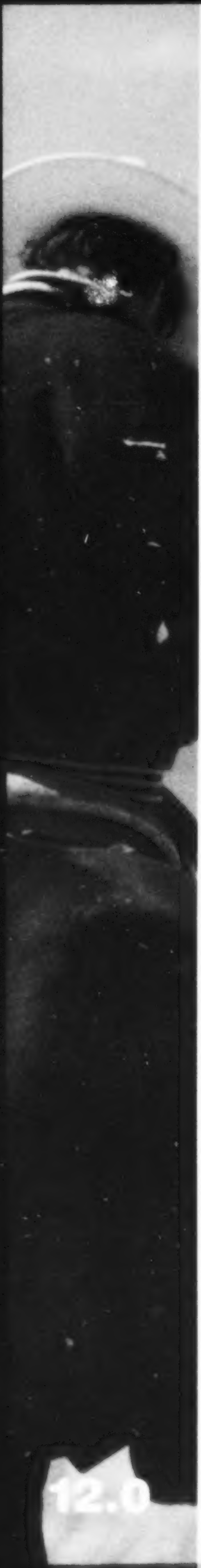
To deal with conflict effectively:

- Take the matter seriously.
- Don't try to deny there's a problem and hope it will go away.
- Be diplomatic. Stay calm. Don't get angry or defensive. Don't blame, accuse or belittle other people in the process.
- Don't let small, specific conflicts mushroom into big, broad conflicts.
- Ask lots of questions. Find out what the other person is upset about. Don't debate the validity of their concerns.
- Identify the real issues. What people say may be quite different from what they're really concerned about. Often people's concerns are rooted in fear of change or the unknown or a lack of understanding, or fear of losing control or the ability to influence decisions that will affect them.
- Listen to and validate concerns. Acknowledge understanding of the concerns and offer to look into the matter.
- Be prompt when getting back to complainants with the information they need to ease their concerns.
- Stay on top of on-going problems. Keep people informed of changes on the farm and progress being made.
- Do whatever is practical to fix problems and mitigate damage.
- Admit to mistakes. Take responsibility for employees' actions.
- Apologize. Make amends if possible.
- When others make mistakes, help them save face.
- Shift the emphasis to mutually acceptable solutions.

Communication is crucial when dealing with conflict. Producers must understand why the other party feels the way it does. Ask questions if concerns are unclear and try to understand the other person's perspective.

Consequences of failing to problem solve may include:

- Bad publicity.
- Lost credibility.
- Fines and penalties.
- Loss of goodwill.
- Project delays, escalated costs.
- Increased difficulty to resolve future conflicts.
- Litigation – lawsuits and appeals.
- Referendums, petitions.
- More regulations for the whole industry.



12.3 For More Information

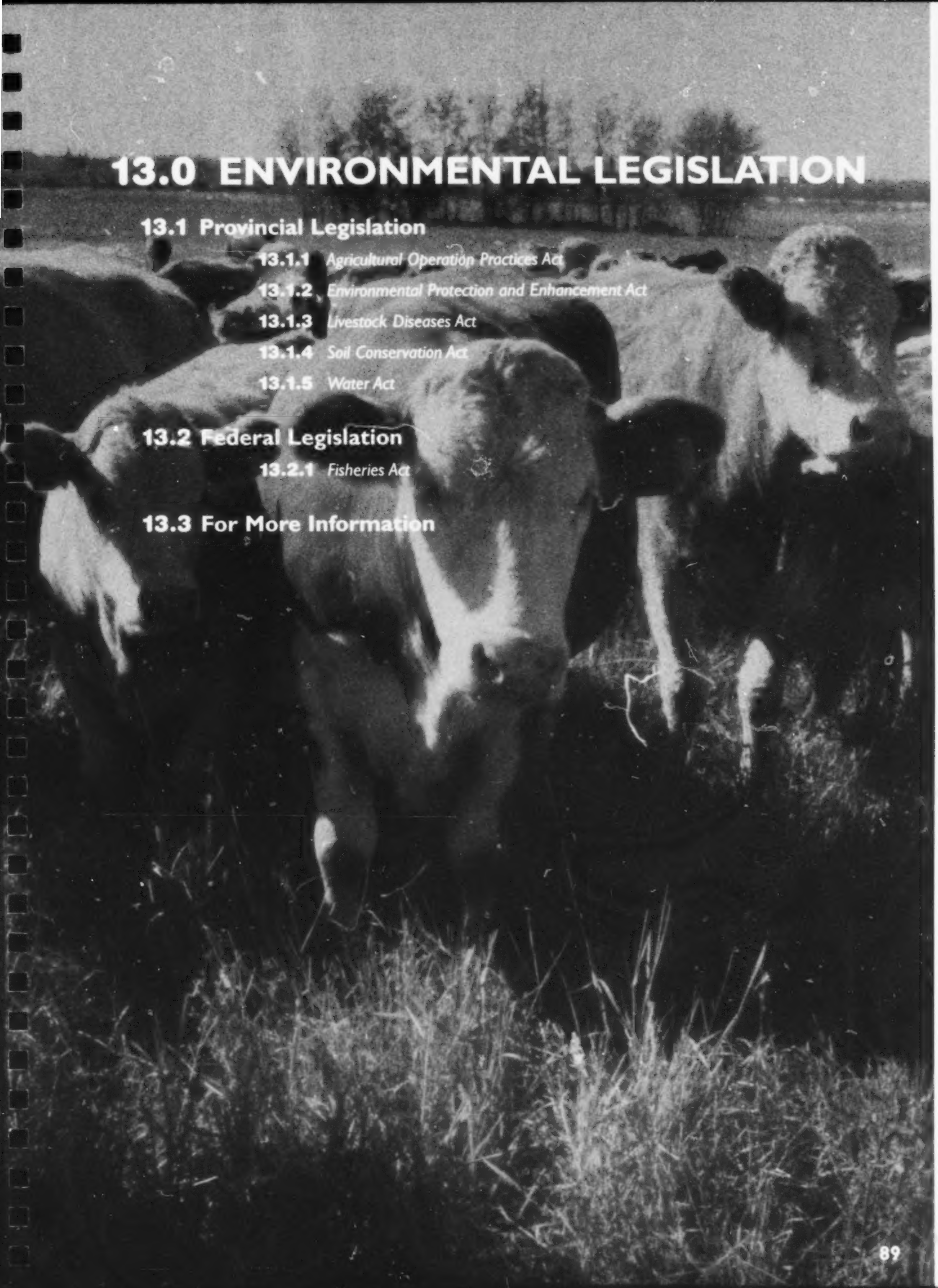
Contact the following offices for the publications listed or for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca
- *Building Community Partnerships.*
- *Building Community Support for Your Project.*
- *Living in Harmony with Neighbours.*
- *Livestock Producers as Good Neighbours.*

Canadian Farm Business Management Council
(613) 237-9060
- *Preventing, Managing and Resolving Conflicts on Canadian Farms.*
- *Farming with Neighbours.*

Human Resources Development Canada
www.hrdc-drhc.gc.ca
- *The Community Development Handbook: A Tool to Build Community Capacity.*

Hoard's Dairyman
www.hoards.com
- *Getting Along with Non-farm Neighbours – Advice and Tips from Pennsylvania Dairy Farmers.*



13.0 ENVIRONMENTAL LEGISLATION

13.1 Provincial Legislation
- **13.1.1** *Agricultural Operation Practices Act*
- **13.1.2** *Environmental Protection and Enhancement Act*
- **13.1.3** *Livestock Diseases Act*
- **13.1.4** *Soil Conservation Act*
- **13.1.5** *Water Act*

13.2 Federal Legislation
- **13.2.1** *Fisheries Act*

13.3 For More Information

13.0 ENVIRONMENTAL LEGISLATION

The following section provides an overview of the major pieces of environmental legislation that affect cow/calf producers. A complete review of all the environmental legislation and regulations is beyond the scope of this manual. This overview is provided for information purposes only and should not be relied upon as legal advice. Producers should consult the actual statutes and regulations for a complete understanding of their obligations under each piece of legislation that is summarized below. Producers are also advised to consult a lawyer with respect to the application and interpretation of the statutes and regulations.

13.1 Provincial Legislation

The following provincial environmental legislation affects cow/calf operators:

- *Agricultural Operations Practices Act.*
- *Environmental Protection and Enhancement Act.*
- *Livestock Diseases Act.*
- *Soil Conservation Act.*
- *Water Act.*

13.1.1 *Agricultural Operation Practices Act*

Cow/calf producers need to be aware of two parts of the *Agricultural Operation Practices Act* (AOPA). The first part deals with nuisance. Nuisance complaints associated with agricultural operations are first investigated by the Natural Resources Conservation Board (NRCB). If it is found that the operation is managed in accordance with AOPA, the Farmers' Advocate of Alberta will then deal with the complaint. The first effort, handled by the NRCB, will attempt to mediate disputes. If the complaint is not resolved, the Farmers' Advocate will establish an Agricultural Practices Review Committee, comprised of industry peers and rural landowners, to determine if the agricultural operation in question is following generally accepted farming practices. This committee will also attempt to further mediate complaints and prepare a report, which can be used by the court system, if complaints are taken forward.

The second part of AOPA that is of concern to cow/calf producers governs livestock and manure. There are two parts to this: all livestock operations must adhere to the rules set forward in the Act, and new or expanding operations above a specified threshold will be required to go through an approval process.

Regulations governing seasonal feeding and bedding sites, nutrient management, and manure storage and handling (including short-term storage of solid manure) are discussed throughout this manual. Cow/calf producers must be aware of legislation in these areas.

The NRCB is responsible for enforcing the legislation and issuing approvals for new and expanding operations.

13.1.2 *Environmental Protection and Enhancement Act*

The purpose of the *Environmental Protection and Enhancement Act* (EPEA) is to support and promote the protection, enhancement and wise use of the environment. Environment includes: air, land and water; all layers of the atmosphere; all organic and inorganic matter and living organisms; and, the interacting natural systems that include each of the above components. The EPEA is directed at any activity that would have an adverse effect on the environment, human health or safety, or property. The EPEA is wide-ranging and no activity is automatically exempt from its application. It applies to all agricultural operations and not just those governed by AOPA.

The EPEA applies to the release of substances that cause or may cause an adverse effect on the environment, human health or safety, and property. It specifically applies to the drilling or reclamation of a water well or borehole, designated livestock operations and pesticide application.

Agricultural operators have a duty to report any releases that may cause an adverse effect on the environment to Alberta Environment. Failure to report a release can lead to significant fines. Once an operator has reported a release, the operator must also identify the steps that will be taken to prevent harm to the environment and to prevent the release from happening again.

Depending on the type of release, the fines issued by Alberta Environment can range from $50,000 to $1,000,000. This is a strict liability statute, meaning that if the operator knowingly contravened the Act, the fine will be larger. Under certain sections of the Act, a person will not be convicted of an offence if that person establishes that all reasonable steps were taken to prevent its commission.

It is beyond the scope of this manual to provide a complete summary of the EPEA. With respect to environmental concerns, producers should seek the assistance of environmental consultants and lawyers as it is a very specialized and complex area of law.

13.1.3 *Livestock Diseases Act*

Under the *Livestock Diseases Act*, livestock is defined as wild animals and birds, whether captive or not, and domestic animals and birds. It does not include fish. This Act is aimed at preventing the spread of communicable diseases. To eliminate the possibility of communicable disease, the Act permits the government to appoint inspectors, establish control areas in the event of a disease outbreak, establish quarantine areas, and seize and destroy infected animals. The only disease of cattle that has been included in the regulations is salmonellosis. As with the other legislation, contravention of this Act and regulations is an offence, punishable by a fine of not more than $10,000, imprisonment of not more than one year, or both.

Under the *Destruction and Disposal of Dead Animal Regulation*, a dead animal is defined as a domestic mammal or bird, or part thereof, that has died from a cause other than having been slaughtered for human consumption, and also includes inedible offal or condemned material from animals slaughtered for human consumption.

Dead animals must be disposed of within 48 hours of death unless they are stored for not more than one week in an enclosed impervious structure or are completely frozen, whether outside in the winter months or in a freezer. This Regulation governs the natural disposal of dead animals. Natural disposal is not allowed if the animal has been euthanized with drugs or other chemical substances. In these cases, the carcass must be buried on a farm or in a landfill, burned, composted or transported to a licensed rendering plant. This Regulation also governs the feeding of dead animals to other food-producing animals. For more information, see Section 10.

13.1.4 *Soil Conservation Act*

The *Soil Conservation Act* applies to all landholders. A landholder is defined as the occupant of the land or, if there is no occupant, the owner. Under this Act, every landholder is required to take appropriate measures to prevent soil loss or deterioration. If soil loss or deterioration is taking place, the landholder must stop the loss or deterioration from continuing. If a landowner does not voluntarily take remedial measures, provisions of the Act direct that such measures be taken. If a landholder does not comply with these directions, the local authority can implement the remedial measures and charge the cost to the landholder. Landholders can appeal any direction made under the Act and, as with the other legislation, there are offence provisions for failure to comply with the Act or the regulations. The prescribed penalty is a fine of not more than $500 for each day or part of a day that the offence continues, to a maximum fine of not more than $10,000.

13.1.5 *Water Act*

The *Water Act* applies to all water on or underground, whether in liquid or solid state. The purpose of this Act is to support and promote the conservation and management of water, including the wise allocation and use of water.

Part three of the Act deals with the right to divert water and the priority of those rights. If a producer owns or occupies land that adjoins a river, stream, lake, natural watercourse or other natural water body, or land under which groundwater exists, and diverts water from these sources for the purpose of raising animals or applying pesticides to crops, that producer is considered an exempt agricultural user. As part of a farm unit, the producer can divert up to 6,250 cubic metres of water per year without an approval, licence or registration. However, they do not have any priority rights unless an approval or licence has been issued or a registration effected with respect to that diversion.

If a producer owns or occupies land that adjoins a river, stream, lake, natural watercourse or other natural water body or land under which groundwater exists, and diverts water for the sole purpose of household use, that producer is also an exempt agricultural user and does not require an approval or licence. This right can be limited if there is or may be a significant adverse affect on the aquatic environment, on a licensee or another traditional agricultural user.

A traditional agricultural user is a person who owns or occupies land that adjoins a river, stream, lake, natural watercourse or other natural body of water, or under which groundwater exists and for which there is a registration under the Act. These users have the right to divert up to 6,250 cubic metres of water from the sources authorized in the registration for the purpose of raising animals or applying pesticides to crops, as part of a farm unit, as authorized by the registration.

For more information on the priority of rights to users refer to Division 2, Sections 27 through 31, of the Act.

Part four of the Act deals with approvals, licences, preliminary certificates and registrations. With the exception of the above noted diversions, all other water diversions require an approval, licence, preliminary certificate or registration. The advantage of registration is that it gives the user priority to the water in accordance with the provisions of the Act. Registration also has the advantage of being inseparable from the land and is attached to the land when any dispositions occur.

In addition to complying with the provisions of the *Water Act*, users are also required to comply with the Water (Ministerial) Regulation. Producers should be aware of Sections 35 through 71, which deal with water wells and, in particular, site selection, drilling, construction, covering, reclamation, servicing, monitoring, deepening, operating, completing, equipping, disinfection, reconditioning, testing and maintenance. These activities must be done in accordance with this Regulation.

13.2 Federal Legislation

Cow/calf producers should be aware of the federal *Fisheries Act* and how it may affect their operations.

13.2.1 *Fisheries Act*

The *Fisheries Act* applies to all internal waters of Canada inhabited by fish or with the potential to support fish. It is intended to preserve fish and fish habitat in Canada.

An obstruction across or in any stream that interferes with the free passage of fish is not in the public interest. If the construction of a fish-way or canal is not feasible, money must be paid to construct, operate and maintain a fish hatchery to maintain the annual return of migratory fish.

No person is permitted to carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat (HADD).

Except where authorized, no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish. The deleterious substance cannot be deposited in a place where it would eventually enter water frequented by fish.

A deleterious substance is any substance or water containing a substance that would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water.

The Department of Fisheries and Oceans is responsible for the administration of the Act.

Any person who contravenes the parts of the *Fisheries Act* that deal with fish habitat and pollution prevention can be guilty of an offence punishable on summary conviction or an indictable offence. Depending on which section is breached, whether it is a summary or indictable offence and whether it is the first or subsequent offence, the person can be fined up to a maximum of $1,000,000 or imprisoned for up to three years, or both. The offender can be held responsible for all costs and expenses associated with measures taken to prevent the deposit of a deleterious substance or to counteract, mitigate or remedy any adverse effects that result or may reasonably be expected to result from such a deposit, and to commercial fisherman for loss of income.

Liability under the Act for contravention of these sections is absolute and does not depend on proof of fault or negligence. However, there is no liability if the accused can establish that the occurrence giving rise to liability was wholly caused by an act of war, hostilities, civil war, insurrection or a natural phenomenon of an exceptional, inevitable and irresistible character, or an act or omission with intent to cause damage by a person other than a person for whose wrongful act or omission the accused person is by law responsible.

If any contravention of this Act is committed on or continues for more than one day, it constitutes a separate offence for each day on which it occurs. Companies, officers, directors, employees and agents can be found liable under the Act; however, there is a statutory due diligence defence under this part.

No person can be convicted of an offence if the person establishes that the person exercised all due diligence to prevent the commission of the offence or reasonably and honestly believed in the existence of facts that, if true, would render the person's conduct innocent. If a person acquires a monetary benefit as a result of contravening the Act, the court can order that the amount of the monetary benefit be paid as an additional fine.

No proceedings may be commenced later than two years after the occurrence to which the proceedings would relate could reasonably be expected to have become known.

13.3 For More Information

The information provided in this manual regarding the legal obligations of cow/calf producers in Alberta is for information purposes only and should not be relied upon as legal advice. Cow/calf producers should consult a lawyer as the facts of each situation may change the producer's legal rights, or the law may change.

Copies of the Acts and Regulations can be obtained online or via mail from the Queen's Printer, 1-780-427-4952 (toll-free, dial 310-0000 first). Web site: www.qp.gov.ab.ca.

Contact the following offices for more information.

Alberta Agriculture, Food and Rural Development (AAFRD)
Agriculture Information Centre 1-866-882-7677
Publications 1-800-292-5697
www.agric.gov.ab.ca

Natural Resources Conservation Board
1-866-383-6722
www.nrcb.gov.ab.ca

Alberta Environment
(780) 944-0313
www.gov.ab.ca/env

Department of Fisheries and Oceans
(204) 983-5000
www.dfo-mpo.gc.ca

Producers can also contact individual consultants and lawyers for more information.

BENEFICIAL MANAGEMENT PRACTICES

Environmental Manual for Alberta Cow/Calf Producers

Alberta Beef Producers

Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT